

BSc_ComputerScience

| Title of the Course | English-I | | | | | | | | | | |
|--|---|---|----------------------------------|-------------------------|--------------------|---|---|---|--|--|--|
| Course Code | AEC0201[T] | | | | | | | | | | |
| Part A | | | | | | | | | | | |
| Year | 1et | Semester | 2nd | Cradits | L | т | Р | С | | | |
| loui | 150 | Gemester | Zhu | oreans | 2 | 0 | 0 | 2 | | | |
| Course Type | Theory only | | | | | | | | | | |
| Course Category | Ability Enhancement Courses | | | | | | | | | | |
| Pre-Requisite/s | The students h communication | nave a basic knowledge and understand n. | ding of the English language and | Co-Requisite/s | Commun developn | Communication skills, Leadership development etc. | | | | | |
| Course Outcomes CO1- Determine interpersonal skills and be an effective goal-oriented team player(BL1-Remember) CO2- Elaborate creativity and lateral thinking(BL2-Understand) CO3- Examine attitudes, emotional intelligence and understand its influence on behavior(BL3-Apply) CO4- Justify approaches to conflict resolution (BL4-Analyze) CO5- Evaluate qoal setting, management, decision-making skills (BL5-Evaluate) | | | | | | | | | | | |
| Coures Elements | Skill Developm Entrepreneurs Employability × Professsonal E Gender × Human Values Environment × | nent ✓ hip X ✓ Ethics ✓ | SDG (Goals) | SDG4(Quality education) | | | | | | | |

| Part B | | | | | | | | | | |
|----------|---|----------------------------------|-------|--|--|--|--|--|--|--|
| Modules | Contents | Pedagogy | Hours | | | | | | | |
| Module 1 | Where the Mind is Without Fear, The Tryst with Destiny The Hero, Indian Weavers The Portrait of a Lady The Solitary Reaper | Classroom Lecture, PPts, Videoes | 10 | | | | | | | |
| Module 2 | Basic Language Skills Synonyms, Antonyms, Homonyms, Word Formation, Prefix, Suffix | Classroom Lecture, PPts, | 6 | | | | | | | |
| Module 3 | Uncountable Noun, Verb, Tense, Adverb | Classroom Lecture, PPts, | 6 | | | | | | | |
| Module 4 | Trading Comprehension, Unseen Passage | Classroom Lecture, PPts, Videos | 4 | | | | | | | |
| Module 5 | Introduction to Report Writing, Major Objectives of Writing Reports, Significance of Business/Technical, Types and Forms of Reports, Styles of Writing Reports – Printed format, Memo Format, Letter Format, Book/Letter Text Format, Layout and Structure of Reports, Components of Report Writing. | Classroom Lecture, PPts, Videos | 5 | | | | | | | |

| Part D(Marks Distribution) | | | | | | | | | | |
|----------------------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Theory | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 40 | 12 | 60 | | | | | | |
| Practical | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |

| Part E | | | | | | | |
|------------------|---|--|--|--|--|--|--|
| Books | C. Muralikrishna and S. Mishra (2011) Communication Skills for Engineers, Pearson education. ISBN: 9788131733844 | | | | | | |
| Articles | Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998. | | | | | | |
| References Books | Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi. | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/109103020 | | | | | | |
| Videos | https://nptel.ac.in/courses/109103020 | | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | - | - | - | 2 | 2 | - | - | - | 2 | - | - | 1 | - | 1 |
| CO2 | 2 | 2 | 1 | 2 | 2 | 2 | - | - | - | 2 | - | - | 1 | - | 3 |
| CO3 | 2 | 1 | 1 | - | 1 | - | - | - | - | 2 | - | - | 3 | 2 | 3 |
| CO4 | 3 | 2 | - | 2 | 1 | - | - | - | - | 2 | - | - | 2 | 3 | 3 |
| CO5 | 3 | 2 | - | 2 | 1 | - | - | - | - | 2 | - | - | 2 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_PCM

| | | | - · · _ | | | | | | | | |
|---|---|--------------------------------------|----------------------------------|-------------------------|--|---|---|---|--|--|--|
| Title of the Course | English-I | | | | | | | | | | |
| Course Code | AEC0201[T] | | | | | | | | | | |
| | | | Part A | | | | | | | | |
| Voor | 1 ot | Somostor | and | Credite | L | т | Р | С | | | |
| Teal | 151 | Semester | 210 | oreans | 2 | 0 | 0 | 2 | | | |
| Course Type | Theory only | | | | | | | | | | |
| Course Category | Ability Enhancement Courses | | | | | | | | | | |
| Pre-Requisite/s | The students h communication | ave a basic knowledge and understand | ding of the English language and | Co-Requisite/s | uisite/s Communication skills, Leadership development etc. | | | | | | |
| Course Outcomes & Bloom's Level | Course Outcomes & Bloom's Level CO1- Determine interpersonal skills and be an effective goal-oriented team player(BL1-Remember) CO2- Elaborate creativity and lateral thinking(BL2-Understand) CO3- Examine attitudes, emotional intelligence and understand its influence on behavior(BL3-Apply) CO4- Justify approaches to conflict resolution.(BL4-Analyze) CO5- Evaluate goal setting, management, decision-making skills.(BL5-Evaluate) | | | | | | | | | | |
| Skill Development ✓ Entrepreneurship × Employability ✓ Professsonal Ethics ✓ Gender × Human Values ✓ | | | SDG (Goals) | SDG4(Quality education) | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|----------|---|----------------------------------|-------|
| Module 1 | Where the Mind is Without Fear, The Tryst with Destiny The Hero, Indian Weavers The Portrait of a Lady The Solitary Reaper | Classroom Lecture, PPts, Videoes | 10 |
| Module 2 | Basic Language Skills Synonyms, Antonyms, Homonyms, Word Formation, Prefix, Suffix | Classroom Lecture, PPts, | 6 |
| Module 3 | Uncountable Noun, Verb, Tense, Adverb | Classroom Lecture, PPts, | 6 |
| Module 4 | Trading Comprehension, Unseen Passage | Classroom Lecture, PPts, Videos | 4 |
| Module 5 | Introduction to Report Writing, Major Objectives of Writing Reports, Significance of Business/Technical, Types and Forms of Reports, Styles of Writing Reports – Printed format, Memo Format, Letter Format, Book/Letter Text Format, Layout and Structure of Reports, Components of Report Writing. | Classroom Lecture, PPts, Videos | 5 |

Part D(Marks Distribution)

| Theory | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 40 | | 40 | 12 | 60 | | | | | | |
| Practical | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| | | | | | | | | | | |

| | i ait L | | | | | | |
|--|---|--|--|--|--|--|--|
| Books C. Muralikrishna and S. Mishra (2011) Communication Skills for Engineers, Pearson education. ISBN: 9788131733844 | | | | | | | |
| Articles | Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster, 1998. | | | | | | |
| References Books | Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi. | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/109103020 | | | | | | |
| Videos | https://nptel.ac.in/courses/109103020 | | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | - | - | - | 2 | 2 | - | - | - | 2 | - | - | 1 | - | 1 |
| CO2 | 2 | 2 | 1 | 2 | 2 | 2 | - | - | - | 2 | - | - | 1 | - | 3 |
| CO3 | 2 | 1 | 1 | - | 1 | - | - | - | - | 2 | - | - | 3 | 2 | 3 |
| CO4 | 3 | 2 | - | 2 | 1 | - | - | - | - | 2 | - | - | 2 | 3 | 3 |
| CO5 | 3 | 2 | - | 2 | 1 | - | - | - | - | 2 | - | - | 2 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Genetic Engine | Genetic Engineering | | | | | | | | | | |
|--|---|----------------------------------|-------------------------------|-------------------------|---|---|---|---|--|--|--|--|
| Course Code | BSBT 401 (T) | 3SBT 401 (T) | | | | | | | | | | |
| Part A | | | | | | | | | | | | |
| Voor | and | Samastar | 4th | Cradita | L | т | Р | С | | | | |
| Tear | 2110 | Semester | 401 | Creats | 3 | 0 | 1 | 4 | | | | |
| Course Type | Embedded theory and lab | | | | | | | | | | | |
| Course Category | Disciplinary Major | | | | | | | | | | | |
| Pre-Requisite/s | Student must h information | nave the detailed knowledge of G | ene expression and hereditary | Co-Requisite/s | Detailed study of genomics, proteomics and metabolomics tool | | | | | | | |
| Course Outcomes & Bloom's Level | Course Outcomes & Bloom's Level CO1- To remember the role of all the enzymes used in the DNA editing (BL1-Remember) CO2- To understand the method of creating new molecules such as DNA & RNA(BL2-Understand) CO3- To understand the importance Nucleic acid editing tools(BL2-Understand) CO4- To evaluate the applications of in various fields such as research, Agriculture, Pharmaceutical industries(BL5-Evaluate) CO5- To apply the understanding of creation of new DNA, RNA & Protein and its use in different Fields.(BL3-Apply) | | | | | | | | | | | |
| Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✓ Gender × Human Values ✓ Environment ✓ | | | SDG (Goals) | SDG4(Quality education) | | | | | | | | |

| | | Part B | | | | |
|---------|--|--|---|--|--|--|
| Modules | Contents | Pedagogy | | | | |
| 1 | Introduction to gene cloning and its necessity: DNA modifying enzymes: Restriction enzymes (RE)- structure function and types, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc Cloning methods. linkers and adaptors. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | |
| 2 | Methods of introduction of DNA into living cells, E.coli, plant and animal cells, Genetic transformation in plants:Agrobacteriun mediated transformation in plants,structure and features of Ti and Ri plasmids.Genomic libraries and cDNA libraries. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | |
| 3 | Cloning vectors: Plasmids and Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC and YAC) for E.coli, yeast. Strategies for identification of recombinant clones containing cloned genes: Nucleica acid hybridization, immune screening etc. Expression vectors for E.coli andYeast. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | |
| 4 | Tools for RDT: Restriction mapping, Southern and northern blotting, Forensic application of biotechnology: DNA fingerprinting and its applications, forensic medicine Molecular Pharming: Application | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | |
| 5 | Applications of RDT, Production of recombinant protein (Insulin, Growth hormone), production of Recombinant vaccine. Golden rice, Artifical seed production, biofertilizers and biopesticide production GM crops and GM food | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | |

| | Part C | | | | | | | | | | |
|---------|---|--|---------------|--------|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | |
| 1 | Preparation of stock and buffer solutions for DNA isolation | Experiments | BL3-Apply | 2 | | | | | | | |
| 2 | Isolation of DNA from yeast cells. | Experiments | BL3-Apply | 2 | | | | | | | |
| 3 | Isolation of DNA from Plant cell. | Experiments | BL3-Apply | 2 | | | | | | | |
| 4 | Isolation of plasmid DNA | Experiments | BL3-Apply | 2 | | | | | | | |
| 5 | Agarose gel electrophoresis of Genomic DNA | Experiments | BL4-Analyze | 2 | | | | | | | |
| 6 | Isolation of RNA | Experiments | BL4-Analyze | 2 | | | | | | | |
| 7 | Quantification of DNA by spectrophotometer(260/280nm) | Experiments | BL4-Analyze | 2 | | | | | | | |
| 8 | To isolate the Auxotrophic mutants from the mixed culture sample of Microorganism | PBL | BL5-Evaluate | 3 days | | | | | | | |

| Part D(Marks Distribution) | | | | | | | | | | |
|----------------------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Theory | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | |
| | | | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | |

| Part E | | | | | | | |
|------------------|---|--|--|--|--|--|--|
| Books | TA Brown, Gene cloning 4 edition | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078015/ | | | | | | |
| References Books | James D watson.Molecular Biology Of gene, 4 edition | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102103074 | | | | | | |
| Videos | https://nptel.ac.in/courses/102103074 | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 3 | - | - | 2 | - | - | - | - | - | - | 1 | - | 3 |
| CO2 | 1 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | - | 2 |
| CO3 | 1 | 2 | 3 | - | - | - | 3 | - | - | - | - | - | 3 | 1 | - |
| CO4 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | 1 | 2 | 3 | - | - | 2 | - | - | - | - | - | - | - | - | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Animal Tissue Culture | | | | | | | | | | |
|------------------------------------|--|---|-------|---|-------|---|---|---|--|--|--|
| Course Code | BSBT 601 (T) | 601 (T) | | | | | | | | | |
| | | Pa | art A | | | | | | | | |
| | | a <i>i</i> | | | L T P | | Р | С | | | |
| Year | 3rd | Semester | 6th | Credits | | 0 | 1 | 4 | | | |
| Course Type | Embedded theory and | edded theory and lab | | | | | | | | | |
| Course Category | Disciplinary Major | sciplinary Major | | | | | | | | | |
| Pre-Requisite/s | Student must be aware | Student must be aware of cell,tissues, culture media for the in vitro regeneration of cell organs. Co-Requisite/s | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To understand the Animal tissue culture: and how does it interact with living and non-living molecules(BL2-Understand) CO2- To Understand media constituents and media formulation strategies for mamalian cell culture.(BL2-Understand) CO3- Develop basic aseptic skills for mammalian cell culture and their applications.(BL3-Apply) CO4- To Develop proficiency in mammalian cell culture and the maintenance of cell lines.(BL3-Apply) CO5- To Apply cell and molecular techniques to in vitro situations.(BL3-Apply) | | | | | | | | | | |
| Coures Elements | Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✓ Gender × Human Values ✓ Environment ✓ | | | SDG3(Good health and well-being) SDG4(Quality education) | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|---|--|-------|
| I | Introducción: History Cell culture enchiques, Equipment, and sterilization methodology. Introduction to animal cell cultures: Nutritional and physiological: Growth factors and growth parameters | Lecture methods, demonstrations, experiments, field visit, Activity based learning | 8 |
| 11 | Primary cell cultures, Establishment and maintenance of primary cell cultures of adherent and non-adherent cell lines, fibroblasts, endothelial cells, embryonic cell lines and stem cells. Organ culture: Methods, behavior of organ explants and utility of organ culture, whole embryo culture. | Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning | 9 |
| Ш | Secondary cell cultures, □Establishment and maintenance of secondary mammalian and insect cell lines, Characterization of cell lines, □Karyotyping, biochemical and genetic characterization of cell lines | Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning | 8 |
| IV | Production of the vaccine in animal cells: □use of Hybridoma for production of monoclonal antibodies.Cell cloning and selection. Transfection & transformation of cell. Commercial scale production of animal cells, stem and their application. Application of animal cell culture for in vitro testing of drugs; Testing of toxicity of environmental pollutants in cell. | Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning | 9 |
| v | Scale-up: Scale-up in suspension: Rotating chambers; Perfused suspension cultures; Fluidized bed reactors for suspension culture. Scale-up in monolayers: Multisurface propagators; Multiarray disks, spirals, and tubes; Roller culture; Microcarriers; Perfused monolayer cultures; Membrane perfusion; Hollow fiber perfusion; Matrix perfusion; Microencapsulation; Growth monitoring | Lecture methods, demonstrations, experiments, field visit, Activity based learning, Project based learning | 9 |

| | Part C | | | | | | | | | | |
|---------|--|--|----------------|---------|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | |
| I | Introdcution to animal tissue culture lab. | Experiments | BL2-Understand | 2 | | | | | | | |
| П | Prerparation of Hank's Balanace salt solution | Experiments | BL3-Apply | 2 | | | | | | | |
| 111 | To culture the animal tissue in the prpeared media | Experiments | BL3-Apply | 3 | | | | | | | |
| IV | To check the viability of the cell and count the cell number | Experiments | BL4-Analyze | 3 | | | | | | | |
| V | Observation of polymorpho nuclear monocytes | Experiments | BL4-Analyze | 2 | | | | | | | |
| VI | To perform skin grafting | Internships | BL6-Create | 1 month | | | | | | | |
| VII | To observed the various cell lines and tissues under culture media for its growth and development | PBL | BL4-Analyze | 1 week | | | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|
| Theory | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | |
| | | | Practical | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | | |

| Books | Freshney, Wiley-Liss, Culture of Animal Cells, 5th Edition-2005 | | | | | | |
|------------------|---|--|--|--|--|--|--|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7325846/ | | | | | | |
| References Books | Culture of Animal Cells: A Manual of Basic Technique (6th Edition) R. Ian Freshney. REQUIRED. It is in your best interest to bring this book or the required chapters to class. | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102106081 | | | | | | |
| Videos | https://nptel.ac.in/courses/102106081 | | | | | | |

Part F

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 3 | 3 | - | 2 | 2 | 3 | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 1 | 3 | 2 | - | - | - | - | - | - | - | 3 | 2 |
| CO3 | 3 | 2 | - | 1 | 3 | 2 | 1 | - | - | - | - | 2 | 1 | 1 | 1 |
| CO4 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | - | - | - | - | - | 2 | 3 | 2 |
| CO5 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | - | - | - | - | - | 2 | 2 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Research | Methodology | | | | | | | | | |
|------------------------------------|--|---|--|---|--|---|---|--|--|--|--|
| Course Code | BSBT 702 | BT 702 (T) | | | | | | | | | |
| | Part A | | | | | | | | | | |
| Voar | 4th | Somostor | Zth | Cradita | L | Т | Р | с | | | |
| i cai | 4un Semester | Gemester | 7.01 | Greats | 4 | 0 | 0 | 4 | | | |
| Course Type | Theory or | nly | | | | | | | | | |
| Course Category | Discipline | cipline Core | | | | | | | | | |
| Pre-Requisite/s | Student s statistics | should have some basic | knowledge of | Co-Requisite/s | Should have understanding of the basic concepts of different types of research and their purposes | | | | | | |
| Course Outcomes & Bloom's Level | CO1- The CO2- The with its ap CO3- The verificatio CO4- The CO5- The | e course prepares the s e subject Research Met oplications in other field e course aims to provide e course aims to provide e course aims to provide e course aims to provide | tudent to understand hodology is designed s.(BL2-Understand) e experimental basis, e basis of analyzing th e basis of experiment | the basic concepts of Research Methodology, for post graduate students of Biotechnology f and to enable students to acquire a specialize ne applications of Research Methodology in va al design, computer applications and use of st | its applications in e or describing the ba ed knowledge and u arious fields of resea atistical tools in rese | xperimental design sic concepts of each nderstanding of data arch and industries.(earch and industries | and future prospects n and every division of a and its applications BL3-Apply) .(BL3-Apply) | (BL1-Remember) f the subject along in experimental | | | |
| Coures Elements | Skill Deve Entreprer Employat Professso Gender > Human V Environm | elopment ✓ neurship X bility ✓ onal Ethics ✓ ć alues X ient X | SDG (Goals) | SDG4(Quality education) | | | | | | | |

| | Part B | | | | | | | | | | |
|---------|---|--|-------|--|--|--|--|--|--|--|--|
| Modules | Contents | Pedagogy | Hours | | | | | | | | |
| 1 | Introduction: Definition of Research, Qualities of Researcher, Components of Research Problem, Various Steps in Scientific Research, Types of Research; Hypotheses Research Purposes - Research Design - Survey Research, Research Reports. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | | | | | |
| 2 | Data Collection: Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire - Sampling Merits and Demerits - Experiments - Kinds - Procedure; Control Observation. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | | | | | |
| 3 | Introduction to Statistics - Probability Theories - Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test - Two Sample Tests / Chi-Square Test, t-test - Standard deviation. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | | | | | |
| 4 | Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | | | | | |
| 5 | Report Writing, Computer application: Use of computers for preparing and presenting Documents. Appropriate Statistical and other relevant packages, internet .Use of MS- Office | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | | | | | |

| | Part C | | | | | | | | | | |
|---------|--|--|----------------|-------|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | |
| 1 | Steps in scientific research methodology | Case Study | BL2-Understand | 2 | | | | | | | |
| 2 | Sampling process | Case Study | BL2-Understand | 2 | | | | | | | |
| 3 | Developing Hypothesis | Case Study | BL2-Understand | 2 | | | | | | | |
| 4 | Data collection | Case Study | BL3-Apply | 2 | | | | | | | |
| 5 | Analysis of Variance | Case Study | BL3-Apply | 2 | | | | | | | |
| 6 | Randomized Block Design | Case Study | BL4-Analyze | 2 | | | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|
| Theory | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| 100 | 40 | 40 | 12 | 60 | 30 | | | | | | |
| | | | Practical | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| | 0 | | | | | | | | | | |

| Books | Research methodology, C. R. Kothari, 6th Edition | | | | | |
|------------------|--|--|--|--|--|--|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037945/ | | | | | |
| References Books | Research methodology, Panneerselvam, R., Prentice Hall of India, New Delhi | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/121106007 | | | | | |
| Videos | https://nptel.ac.in/courses/121106007 | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 1 | - | - | - | - | - | - | 1 | 2 | - | - | - | - | - |
| CO2 | 1 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - |
| CO3 | 1 | 2 | - | - | - | - | - | - | 1 | 2 | - | - | - | - | - |
| CO4 | 1 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - |
| CO5 | 1 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Disaster Managemer | saster Management | | | | | | | | | | |
|------------------------------------|--|---|----------------|-----------|--|---|---|---|--|--|--|--|
| Course Code | BSBT VAC III | | | | | | | | | | | |
| Part A | | | | | | | | | | | | |
| Voor | and Somether | | 2rd | Orre dife | | т | Р | С | | | | |
| Teal | 2110 | Semester | 514 | Credits | | 0 | 0 | 2 | | | | |
| Course Type | Theory only | Theory only | | | | | | | | | | |
| Course Category | Community Engane | Community Enganement and Service | | | | | | | | | | |
| Pre-Requisite/s | To be familiar with th approaches for disas | ne basics of natural disasters as well as anth ster managements. | Co-Requisite/s | | | | | | | | | |
| Course Outcomes & Bloom's Level | C01- To learn types of disasters and its profile in India(BL1-Remember) C02- To understand the causes and impacts of disasters on environment and related case studies of Global and National disasters.(BL2-Understand) C03- To learn about risk reduction approaches of disasters with safety issues in mitigating industrial disasters.(BL3-Apply) C04- To understand the concept of Disaster Management Cycle and its Risk Reduction Measures(BL4-Analyze) C05- To apply the National Acts and policies for mitigating disasters, Role of Army, Police, Community, Corporate, Media etc. for post Disaster Management.(BL5-Evaluate) | | | | | | | | | | | |
| Coures Elements | Skill Development ✓ SDG1(No poverty) Entrepreneurship × SDG4(Quality education) Employability ✓ SDG6(Clean water and sanitation) Professonal Ethics ✓ SDG (Goals) Gender × SDG1(Nu poverty) Human Values × SDG1(Nu poverty) Environment ✓ SDG1(Responsible consuption and product | | | | | | | | | | | |

| | | Part B | |
|---------|--|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Concepts and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks, Capacity buildings) Factors of disasters, Global trends in disaster: urban disasters, pandemics, complex emergencies, Climate change | lecture method, collaborative learning, group dicussions, field visit, | 8 |
| 2 | Classification of disaster: geophysical, hydrological, climatological, meteorological, biological and technological or man-made hazards. Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability. | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |
| 3 | Disaster management cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA). | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |
| 4 | Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |
| 5 | Disaster Management Indian scenario, India's vulnerability profile, Disaster Management Act 2005 and Policy guidelines, Environmental Legislation for Disaster Risk Management in India. Role of information technology in protecting environment and health. Role of NGOs Cases Studies: Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, South India Tsunami, Bihar floods, Plague Surat, COVID-19 pandemic | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |

| | Part C | | | | | | | | | |
|---------|---|--|---------------|-------|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | |
| 1 | Contemporary Disaster Issues in India & World | Case Study | BL4-Analyze | 4 | | | | | | |
| 2 | Disaster Mitigation Methods & Involvement of Technologies | Seminar | BL3-Apply | 4 | | | | | | |

Part D(Marks Distribution) Theory al Evaluati Evé . . alu ati

| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|
| 100 | 40 | 60 | 18 | 40 | | | | | | | |
| | Practical | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |

| Books | Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 • Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361] • Cupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011 • Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010. • Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur |
|------------------|---|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3105552/ |
| References Books | Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. • Cuny, F. 1983. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development 2002. • Govt. of India: Disaster Management Act 2005, Government of India, 2009. National Disaster Management Policy. • Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009- 2012. • Disaster Madeical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no 214, June 2003. • National Institute of Disaster Management • National Disaster Management + National + Disaster Management + National Disaster Management + National Disaster Management + National + Disaster + |
| MOOC Courses | https://nptel.ac.in/courses/124107010 |
| Videos | https://nptel.ac.in/courses/124107010 |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 3 |
| CO2 | 1 | 1 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 2 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 3 | 3 | 3 | 1 | 1 | 3 | 2 | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_PCM

| Title of the Course | Environmental | ronmental Studies | | | | | | | | | | |
|------------------------------------|---|--|--|--|---|---|---|------------------------|--|--|--|--|
| Course Code | BSFC0201[T] | C0201[T] | | | | | | | | | | |
| Part A | | | | | | | | | | | | |
| Veer | 1.01 | Someotor | 0.54 | Credite | L | т | Р | С | | | | |
| Tear | ist Semester | 2nd | Creats | 2 | 0 | 2 | 4 | | | | | |
| Course Type | Theory only | ry only | | | | | | | | | | |
| Course Category | Interdisciplina | rdisciplinary Major | | | | | | | | | | |
| Pre-Requisite/s | | | | Co-Requisite/s | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1The co CO2- At the e Understand) CO3- Ability to CO4- Student | urse shall develop in student nd of the course, it is expecte o distinguish between various s acquire skills for to commu | the scientific background ne ed that students will be able t methods of various pollution nicate, prepare, plan and imp | eded to understand how the earth works and h o identify and analyze environmental problems n analysis. (BL3-Apply) plement the environmental management project | now we, as hu s as well as th ct. (BL4-Analy | iman beings, fit ir ie risks associate i ze) | nto that. (BL1-Re d with these prol | member) blems.(BL2- | | | | |
| Coures Elements | Skill Developr Entrepreneurs Employability Professsonal Gender X Human Value: Environment | ment ✓ ship × ✓ Ethics ✓ s × ✓ | SDG (Goals) | SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG9(Industry Innovation and Infrastructure) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG12(Climate action) SDG14(Life below water) SDG14(Life below water) | | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---|---|--|-------|
| Unit 1. Study of Environment and Ecology | (a) Environment – Definition and Its segments (Atmosphere, Lithosphere, Hydrosphere and Biosphere). (b) Environmental education- Definition, scope, importance, Need for Public Awareness & multidisciplinary nature of Environmental Science. (c) Elements of ecology (d) Ecosystem- Concepts, components, structure & function, energy flow, food chain, food web, ecological pyramids and types. | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 2. Environmental Pollution and Population | (a) Air, water, noise, soil and nuclear pollution- definition, causes, effect and prevention of pollution. (b) Environmental issues (c) Population growth, disparities between countries. (d) Population explosion, family welfare program. (e) Environment and human health. Cleanliness and disposal of domestic waste | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 3. Natural resources, Problems and Conservation | (a) Natural resource- Definition and classification (b) Water resources, Forest resources, Land resources, Food resources and its management (c) Energy resources- Classification and alternatives of conventional energy resources (Solar energy, geothermal energy, wind energy, nuclear energy, biomass and biogas energy) | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 4. Bio-diversity and its Protection | (a) Introduction- Genetic, species and ecosystem diversity. (b) Value of bio-diversity- Consumable use: Productive use, Social, Moral and Aesthetic uses. (c) India as a nation of mega bio-diversity center, bio-diversity at national and local levels. (d) Threats to bio- diversity – Loss of habitat, poaching of wildlife, man and wildlife conflicts. | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 5. Disaster Management and Environmental Laws | (a) Concepts of hazard, Vulnerability, Risks, Natural disasters (earthquake, cyclone, floods, volcanoes), and man made disaster (Armed conflicts and civil strip, Technological disasters, Human settlement, Slow disasters (famine, draught, epidemics) and Rapid onset disasters(Air crash, tidal waves, Tsunami) (b) Disaster Management: Prevention, Preparedness and Mitigation (c) Environmental legislations in India: Air conservation act, water conservation act, environment protection act. Role of information technology in protecting environment and health | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |

| | Part D(Marks Distribution) | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| | Theory | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | | 40 | 12 | 60 | 30 | | | | |
| | | | Practical | · | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| | 0 | | | | | | | | |

| Books | B. S. Chauhan Environmental Science 2008 First Richards T. Wright & Dorothy F. Boorse Environmental Science: Toward a Sustainable Future 2016 S. K. Dhameja Environmental Engg. & Management 2000 |
|------------------|---|
| Articles | |
| References Books | Gilbert M. Masters Introduction to Environmental Engineering and Science 1991 Stanley Manahan & Stanley E. Manahan Environmental Chemistry 2009 |
| MOOC Courses | |
| Videos | |

Course Articulation Matrix

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 3 |
| CO5 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_ComputerScience

| Title of the Course | Environment | vironmental Studies | | | | | | | | |
|------------------------------------|--|---|-------------|--|---|---|---|---|--|--|
| Course Code | BSFC0201[T | SFC0201[T] | | | | | | | | |
| | Part A | | | | | | | | | |
| Voar | 1et | Somostor | and | Gradita | | Т | Р | С | | |
| Tear | 151 | Semester | 2110 | orcuits | 2 | 0 | 2 | 4 | | |
| Course Type | Theory only | sory only | | | | | | | | |
| Course Category | Interdisciplin | erdisciplinary Major | | | | | | | | |
| Pre-Requisite/s | | | | Co-Requisite/s | | | | | | |
| Course Outcomes & Bloom's Level | CO1The c CO2- At the Understand CO3- Ability CO4- Studer | OT - The course shall develop in student the scientific background needed to understand how the earth works and how we, as human beings, fit into that. (BL1-Remember) O2- At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems.(BL2-Inderstand) O3- Ability to distinguish between various methods of various pollution analysis.(BL3-Apply) O4- Students acquire skills for to communicate, prepare, plan and implement the environmental management project.(BL4-Analyze) | | | | | | | | |
| Coures Elements | Skill Develop Entrepreneu Employabilit Professsona Gender X Human Valu Environment | oment √ rship X y √ Il Ethics √ es X t √ | SDG (Goals) | SDG3(Good health and well-being) SDG5(Gender equality) SDG6(Clean water and sanitation) SDG7(Affordable and clean energy) SDG11(Sustainable cities and economies) SDG12(Responsible consuption and production) SDG13(Climate action) SDG14(Life below water) SDG15(Life on land) | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---|--|--|-------|
| Unit 1. Study of Environment and Ecology | (a) Environment – Definition and Its segments (Atmosphere, Lithosphere, Hydrosphere and Biosphere). (b) Environmental education- Definition, scope, importance, Need for Public Awareness & multidisciplinary nature of Environmental Science. (c) Elements of ecology (d) Ecosystem- Concepts, components, structure & function, energy flow, food chain, food web, ecological pyramids and types. | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 2. Environmental Pollution and Population | (a) Air, water, noise, soil and nuclear pollution- definition, causes, effect and prevention of pollution. (b) Environmental issues (c) Population growth, disparities between countries. (d) Population explosion, family welfare program. (e) Environment and human health. Cleanliness and disposal of domestic waste | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 3. Natural resources, Problems and Conservation | (a) Natural resource- Definition and classification (b) Water resources, Forest resources, Land resources, Food resources and its management (c) Energy resources- Classification and alternatives of conventional energy resources (Solar energy, geothermal energy, wind energy, nuclear energy, biomass and biogas energy) | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 4. Bio-diversity and its Protection | (a) Introduction- Genetic, species and ecosystem diversity. (b) Value of bio-diversity- Consumable use: Productive use, Social, Moral and Aesthetic uses. (c) India as a nation of mega bio-diversity center, bio-diversity at national and local levels. (d) Threats to bio- diversity – Loss of habitat, poaching of wildlife, man and wildlife conflicts. | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |
| Unit 5. Disaster Management and Environmental Laws | (a) Concepts of hazard, Vulnerability, Risks, Natural disasters (earthquake, cyclone, floods, volcanoes), and man made disaster (Armed conflicts and civil strip, Technological disasters, Human settlement, Slow disasters (famine, draught, epidemics) and Rapid onset disasters(Air crash, tidal waves, Tsunami) (b) Disaster Management: Prevention, Preparedness and Mitigation (c) Environmental legislations in India: Air conservation act, water conservation act, wildlife conservation act, environment protection act. Role of information technology in protecting environment and health | Lecture with ppt., Diagrams, Flowchart depiction on whiteboard during online/offline lectures, Audio/Video clips, Group discussion. | 6 |

Part D(Marks Distribution)

| | Theory | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | | 40 | 12 | 60 | 30 | | | | |
| | Practical | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| | 0 | | | | | | | | |

| Books | B. S. Chauhan Environmental Science 2008 First Richards T. Wright & Dorothy F. Boorse Environmental Science: Toward a Sustainable Future 2016 S. K. Dhameja Environmental Engg. & Management 2000 |
|------------------|---|
| Articles | |
| References Books | Gilbert M. Masters Introduction to Environmental Engineering and Science 1991 Stanley Manahan & Stanley E. Manahan Environmental Chemistry 2009 |
| MOOC Courses | |
| Videos | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | 2 | 3 |
| CO2 | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 1 |
| CO3 | 1 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | 2 | - |
| CO4 | 1 | 2 | - | 2 | - | - | - | 2 | - | - | - | - | 1 | 2 | 3 |
| CO5 | 1 | 2 | - | - | - | - | - | 2 | - | - | - | - | 1 | - | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Food Additives [T] | | | | | | | | | | |
|------------------------------------|--|--|---|---|--|--|----------------|-----------------|--|--|--|
| Course Code | BSFT-0202 [T] | | | | | | | | | | |
| | Part A | | | | | | | | | | |
| Voor | | | and | Cradita | L | Т | Р | С | | | |
| Tear | 151 | Semester | 2110 | Credits | 4 | 0 | 0 | 4 | | | |
| Course Type | Theory only | | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | | |
| Pre-Requisite/s | Candidates r previous sen | nust have studied food chemistinesters. | y and food microbiology in | Co-Requisite/s | Students should have prior knowledge of preservatives, chemical compounds etc. | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To rem CO2- To und CO3- To prov CO4- To app CO5- To eva | nember the food additives, their lerstand the applications of differ vide the students a specialized ling the subject knowledge in futur luate the theoretical knowledge | classification, properties, usa rent additives in food proces knowledge and understandin re perspectives i.e. such as in different commercialized p | age limit and their importance. (BL1-Rememb sing and nutrition in addition to their stabilizati g in the field of food additives and their utilizati in food processing and new product developm products and implement the same to create pr | er) on and protecti ion(BL3-Apply ent.(BL4-Anal ocessed and v | ion techniques(y) lyze) alue added food | BL2-Understand | d) Evaluate) | | | |
| Coures Elements | Skill Develop Entrepreneu Employability Professsona Gender X Human Value Environment | oment ✓ rship ✓ y ✓ I Ethics ✓ es X ✓ | SDG (Goals) | SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) | | | | | | | |

| | Part B | | | | | | | | | | | |
|---------|--|--|-------|--|--|--|--|--|--|--|--|--|
| Modules | Contents | Pedagogy | Hours | | | | | | | | | |
| 1 | Definitions, classification and functions, need for food additives, Safety concerns, regulatory authorities; Food preservatives- classifications, antimicrobial agents (types, mode of action and their application), Antioxidants (synthetic and natural, mechanism of oxidation inhibition), Chelating agents: types, uses and mode of action | Lecture method, quiz, seminar | 8 | | | | | | | | | |
| 2 | Nutrient supplements, bulking agents, antifoaming agents, Flour improvers, leavening agents, humectants, buffering agents, and anticaking agents. Sweeteners: Introduction, types, properties and uses of saccharin, acesulfame-K, aspartame, HFCS, invert sugar, and sugar alcohols (polyols) as sweeteners in food products | Lecture method, quiz, seminar, quiz | 12 | | | | | | | | | |
| 3 | Flavoring agents: Introduction, types and flavor extraction and stabilization; Flavor enhancers- Introduction and types Coloring agents: Introduction, types, sources, applications, permitted and misbranded colors, color extraction and stabilization techniques | Summarizing, Quiz, Whiteboard, Expert Lecture | 7 | | | | | | | | | |
| 4 | Emulsifiers: Introduction, types, selection of emulsifiers, emulsion stability, and mechanism of action. Thickeners and hydrocolloids: Introduction and types | Lecture method, group discussion, industrial visit | 8 | | | | | | | | | |
| 5 | E-codes, CAS system. Uses and function of food additives in food formulations (different products). Regulation concerning food additives and other categories of ingredients approval and usage in European Union. | Group discussion, lecture, ppt | 10 | | | | | | | | | |

Part C

| | | - | | |
|---------|---|--|---------------|-------|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
| 1 | To detect different gums and thickeners in food samples | Experiments | BL4-Analyze | 2 |

| | Part D(Marks Distribution) | | | | | | | | | |
|---|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| | Theory | | | | | | | | | |
| Total Marks Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation Min. Internal Evaluation | | | | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | 0 | | | | | |
| | | · | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 0 | 40 | 20 | 60 | 0 | | | | | |

| Part E | | | | | | | |
|------------------|--|--|--|--|--|--|--|
| Books | Food Additives by Branen AL, Davidson PM & Salminen S | | | | | | |
| Articles | https://www.researchgate.net/publication/221925228_Food_Additive | | | | | | |
| References Books | Encyclopedia of Food and Color Additives by Gerorge AB Food Antioxidants: Technological, Toxicological and Health Perspective by Madhavi DL, Deshpande SS & Salunkhe DK. Food Flavours. Part A by Morton ID & Macleod AJ Food Proteins:Processing Applications by Shuryo Nakai Food Polysaccharides and Their Applications by Stephen AM | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/126105027 | | | | | | |
| Videos | https://youtu.be/Dm3yP7FF4nl?si=55vFo027nUaRB6jy | | | | | | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 3 | 1 | - | - | - | 1 | - | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | 1 | 2 | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Food Safety Management [T] | | | | | | | | |
|------------------------------------|--|---|-------------------|---|---|---|---|---|--|
| Course Code | BSFT-0503 [T] | | | | | | | | |
| | Part A | | | | | | | | |
| Voor | 2rd | Somostor | 5th | Cradita | L | Т | Р | С | |
| Tear | 310 | Semester | 501 | Creats | 4 | 0 | 0 | 4 | |
| Course Type | Theory only | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | |
| Pre-Requisite/s | Student sho previous ser | uld have studied food laws a nester. | nd regulations in | Co-Requisite/s | Student should have basic knowledge of food born safety and handling principles | | | | |
| Course Outcomes & Bloom's Level | CO1- CO1: Comprehend the practical application of food safety and quality assurance in raw and processed foods(BL1-Remember) CO2- CO2: Conduct the quality assessment of food products using various instruments(BL2-Understand) CO3- CO3: Recognize the sensory evaluation techniques(BL3-Apply) CO4- CO4: Illustrate the detection methods of the adulterants in food products(BL4-Analyze) CO5- CO5: Monitor the implementation of HACCP.(BL5-Evaluate) | | | | | | | | |
| Coures Elements | Skill Develop Entrepreneu Employabilit Professsona Gender X Human Valu Environment | oment X irship X y X I Ethics ✓ es ✓ t X | SDG (Goals) | SDG2(Zero hunger) SDG3(Good health and well-being) SDG6(Clean water and sanitation) | | | | | |

| | I | Part B | |
|---------|---|---|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Food Quality: Introduction to food quality management – Definition, quality concepts & attributes-safety, health, sensory, shelf life, extrinsic attributes, factors affecting food behavior, their measurement and evaluation; Sensory and instrumental methods for testing quality Food adulteration and food safety | Lecture method, class presentation, quiz | 8 |
| 2 | Quality assurance, Total Quality Management; GMP, GHP; GLP, GAP; Sanitary and hygienic practices; Food Safety and Quality Requirements – BRC, HACCP - critical control points, reliability and recal; Quality manuals, Risk assessment, Contamination and illness. Handling of food, Process validation. | Lecture method, quiz, Illustrate with analogies | 8 |
| 3 | Indian & International quality systems and standards like ISO; ISO-9000, ISO-22000, ISO-14000, ISO certification, planning, application, Implementation criteria, requirements, benefits, structure etc. | Lecture method, expert Lecture | 8 |
| 4 | Food Safety and Standards Act of India, 2006; FSS Rules and Regulations, Global Food safety Initiative; inspection, traceability and authentication, certification and quality assurance, documentation and audits | Audio/Video clips, group discussion, lecture with ppt, quiz | 8 |
| 5 | International Food Control Systems/Laws, Regulations and Standards/Guidelines with regard to Food Safety- (i) Overview of CODEX Alimentarius. Commission (Members, Standard setting and Advisory mechanisms: JECFA, JEMRA, JMPR): EFSA, WTO agreements (SPS/TBT). | Audio/Video clips, group discussion, lecture with ppt, quiz | 8 |

| | Part D(Marks Distribution) | | | | | | | | | |
|-------------|---|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| | Theory | | | | | | | | | |
| Total Marks | Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation Min. Internal Evaluation | | | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | 0 | | | | | |
| | | | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| | 0 | | | | | | | | | |

Part E

| Books | Luning, P. A., & Marcelis, W. J. (2020, January 1). Food Quality Management. Brill Wageningen Academic. |
|------------------|---|
| Articles | |
| References Books | Branen, A. L., Davidson, P. M., Salminen, S., & Thorngate, J. (2001, November 1). Food Additives. CRC Press. Fortin, N. D. (2016, October 25). Food Regulation. John Wiley & Sons. |
| MOOC Courses | https://nptel.ac.in/courses/110101010 |
| Videos | https://youtu.be/h5NpTku5BGc?si=yJ2vl7colx6fR5cr |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | - | 1 | 1 | - | 3 | 1 | 1 |
| CO2 | 3 | 1 | 1 | - | - | 1 | - | - | - | 1 | - | - | 3 | 1 | 1 |
| CO3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | - | 3 | 1 | 1 |
| CO4 | 3 | 2 | 2 | - | - | 2 | - | - | - | 1 | - | - | 3 | 1 | 2 |
| CO5 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | - | 3 | 1 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Title of the Course Food Laws and Regulations IT | | | | | | | | |
|------------------------------------|--|--|-------------|---|---|---|-----------------|---|--|
| | | | | | | | | | |
| Course Code | BSFT-0602 [T] | | | | | | | | |
| | Part A | | | | | | | | |
| Year | 3rd | Semester | 6th | Credits | L | т | Ρ | с | |
| i cui | ora | ouncour | Gui | orcalis | 4 | 0 | 0 | 4 | |
| Course Type | Theory only | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | |
| Pre-Requisite/s | Knowledge of food laws and regulations Co-Requisite/s Understand the different Indian and International food laws and their importance | | | | | | heir importance | | |
| Course Outcomes & Bloom's Level | CO1- To understand the different Indian and International food laws and their importance (BL1-Remember) CO2- To learn the different adulterants and hazards and their safety measures (BL2-Understand) CO3- To provide the students a specialized knowledge about implementation of different safety tools and regulation in food industry to produce safe products (BL3-Apply) CO4- To apply the subject knowledge in future perspectives i.e. Retail standards and other regulatory agencies and their importance in controlling the operations. (BL4-Analyze) CO5- To evaluate the theoretical knowledge in Food safety regulations and their implementation in food industry to ensure the quality and safety of the foods (BL5-Evaluate) | | | | | | | | |
| Coures Elements | Skill De Entrepr Employ Profess Gender Human Environ | velopment X eneurship X ability √ ssonal Ethics √ X Values X iment X | SDG (Goals) | SDG1(No poverty) SDG2(Zero hunger) s) SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consuption and production) | | | | | |

| - | | Part B | | | | | |
|---------|--|---|-------|--|--|--|--|
| Modules | Contents | Pedagogy | Hours | | | | |
| 1 | Concept and meaning trends in Food quality and food Safety, food adulteration, food hazards, Natural toxins. Concept, need and importance of food laws, standards and regulations. Food labelling | Lecture method, Quiz, Illustrate with analogies | 06 | | | | |
| 2 | Food Safety and Standards (FSS) Act, 2006, FSSA Rules and Regulations-2011, Provision, definitions and different sections of the Act and implementation, Role, Functions, Structure, Initiatives- Eat Right India, Food Fortification, Clean Street Food Hub, RUCO and various other social and behavioural change initiatives | Lecture method, Quiz, Illustrate with analogies | 10 | | | | |
| 3 | Essential Commodities Act, 1955, Export (Quality Control & Inspection) Act, 1963, Foreign Trade Policy, Plant and Animal Quarantine, Bureau of Indian Standards (BIS) and Agricultural Produce (Grading and Marketing) Act, (1937) - Implementation criteria, requirements, structure, jurisdiction, and applications, Atomic Energy (Radiation. Processing of Food and Allied Products) Rules, 2012 | Lecture method,Expert Lecture | 10 | | | | |
| 4 | International Organizations – FAO (Food & Agriculture Organization), WHO (World Health Organization), Codex Alimentarius Commission (CAC), WTO and its agreements - Role of these agencies in trade, food control, food supply managements, tariff etc | Audio/Video clips, group discussion, lecture with ppt, quiz | 10 | | | | |
| 5 | Food and BRC/IOP standards and International Food standards. Food and Drug Administration (FDA), U.S. Department of Agriculture (USDA), AOAC, OIE, EU | Audio/Video clips, group discussion, lecture with ppt, quiz | 09 | | | | |

Part D(Marks Distribution)

| Theory | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | |
| | Practical | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| | | | | | | | | | |

| Books | Patricia A. Curtis; Food Laws and Regulations by Blackwell publisher |
|------------------|---|
| Articles | |
| References Books | Kiron Prabhakar; A Practical Guide to Food Laws and Regulations ISA; HACCP & ISO-22000. ISO9000-01 |
| MOOC Courses | |
| Videos | |

| | | | | | | | Cours | e Articulatio | on Matrix | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-------|---------------|-----------|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | 1 | 2 | 1 |
| CO2 | 1 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 1 | - | - | 1 | 2 | 1 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | - | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | - | - | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

a Articulation Matrix



BSc_FoodTechnology

| Title of the Course | Research methodology [T] | | | | | | | |
|------------------------------------|--|---|-------------|-------------------------|--|---|---------------------------|---|
| Course Code | BSFT-0704 [T] | | | | | | | |
| | | | | Part A | | | | |
| Voar | 4th | Somostor | Zth | Credite | L | Т | Р | С |
| i cai | 401 | Semester | 701 | oreana | 2 | 0 | 0 | 2 |
| Course Type | Theory or | nly | | | | | | |
| Course Category | Interdiscip | olinary Major | | | | | | |
| Pre-Requisite/s | The student must have completed 3 years BSc in Food Technology | | | Co-Requisite/s | Student should have basic knowledge of mean, median mode, sampling methods and probability | | | |
| Course Outcomes & Bloom's Level | C01- To understand the basic concepts of Research Methodology, its applications in experimental design and data collect as well as analysis. (BL1-Remember) C02- To describe the basic concepts of each and every division of the subject along with its technical writing aspects(BL2-Understand) C03- To provide experimental basis, and to enable students to acquire a specialized knowledge and understanding of data and its applications in experimental verification.(BL3- Apply) C04- To provide basis of analyzing the applications of Research Methodology in various fields of research and industries.(BL4-Analyze) C05- To apply the understanding of statistical tools in evaluation in various samples.(BL5-Evaluate) | | | | | | erification. (BL3- | |
| Coures Elements | Skill Deve Entrepren Employab Professso Gender X Human Va Environm | elopment ✓ eurship X ility X nal Ethics ✓ : alues ✓ ent X | SDG (Goals) | SDG4(Quality education) | | | | |

| | | Part B | |
|---------|--|---|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Research: Definition and types, components and steps; Research Question, Research Problem identification, guidelines for selecting meaningful problem; Research Objective: Definition, broad and specific objectives, Hypothesis: Meaning and sources of research hypothesis Technology transfer: Introduction and procedure. | Lecture methods,Audio/Video clips,group discussion,quiz | 05 |
| 2 | Research Method: Principle, Scientific methods, steps in experimental research, types and problems in experimentation; Importance of survey method, Comparison of survey method with other methods Sampling – steps, size, types, merits and demerits, Data Collection: Sources and types of Data: Ways of data organization and summarization. Standard operating procedure (S.O.P): Introduction and procedure | Lecture methods,Audio/Video-clips | 08 |
| 3 | Data analysis - Estimation of population parameters, mean value, standard error, and variance analysis; Probability Theories; Hypothesis Tests, One Sample Test - Two Sample Test / Chi-Square Test, I-test, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design. | Lecture methods, Audio/Video-clips,group discussion | 08 |
| 4 | Computer application: Use of MS-Office and Excel, Library documentation and Scientific literature searching, Appropriate Statistical and other relevant packages. Research proposal and thesis writing: Purpose of research proposal, Academic/ Project/ Case study proposals, Steps for the preparing proposal and Common mistakes | Lecture methods,Audio/Video-clips,group discussion,quiz | 09 |
| 5 | Methods selecting relevant literature, Features of thesis, Structure of Thesis, Steps in thesis writing, Citation and Referencing: Different ways of work citation, Publication in Research journals: Introduction and its importance, Arrangement of the article; Difference between general and research article. | Lecture methods,Audio/Video-clips,group discussion,quiz | 05 |

| | Part D(Marks Distribution) | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|
| | Theory | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| 100 | 40 | 60 | 18 | 40 | | | |
| | | | Practical | · | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| | 0 | | | | | | |

| Books | Kothan, C. R. (2004, January 1). Research Methodology. New Age International. |
|------------------|---|
| Articles | |
| References Books | Panneerselvam, R. (2014, April 4). RESEARCH METHODOLOGY. PHI Learning Pvt. Ltd. Wilkinson, T. S., & Bhandarkar, P. L. (2003, January 1). Methodology and Techniques of Social Research. Young, P. V. (1956, January 1). Scientific Social Surveys and Research. Englewood Cliffs, N.J. : Prentice-Hall. |
| MOOC Courses | https://nptel.ac.in/courses/110105091 |
| Videos | https://youtu.be/oXnjR00tfBI |

| | | | | | | | Cours | e Articulatio | on Matrix | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-------|---------------|-----------|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 1 | 2 | 2 | - | - | - | - | - | 1 | 3 | 1 | 1 |
| CO2 | 2 | 2 | 3 | 2 | 1 | 1 | - | - | - | 1 | - | - | 3 | 1 | 1 |
| CO3 | 2 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO4 | 1 | 1 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | 3 | 3 | 3 |
| CO5 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | - | - | - | 1 | - | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Functional Foods and Nutraceuticals [T] | | | | | | | | |
|------------------------------------|--|---|-------------|--|-------------|---|---|---|--|
| Course Code | BSFT-0801 [T | BSFT-0801 [T] | | | | | | | |
| | | | Part A | | | | | | |
| Year | 4th | Somostor | 8th | Credits | L | т | Р | С | |
| r cui | | Genesier | | oreans | 3 | 0 | 1 | 4 | |
| Course Type | Embedded the | eory and lab | | | | | | | |
| Course Category | Disciplinary M | ajor | | | | | | | |
| Pre-Requisite/s | students to pass 10+2 with a minimum aggregate of 50% from the science stream with mandatory subjects like PCMB (Physics, Chemistry, Maths, Biology). | | | Co-Requisite/s Students should have basic knowledge of bio-active compounds prsent in various plants and animal products , processing methods. | | | | | |
| Course Outcomes & Bloom's Level | C01- Recognize the importance and link between nutrition and diseases(BL1-Remember) C02- Identify major types of health foods and nutraceutical products in the market(BL2-Understand) C03- To understand the molecular basis of using micronutrients and phytochemicals in prevention of chronic diseases(BL2-Understand) C04- Design and develop foods having health promoting properties(BL6-Create) C05- Critically evaluate the safety and efficacy of using health foods and nutraceutical products. (BL4-Analyze) | | | | | | | | |
| Coures Elements | Skill Developr Entrepreneurs Employability Professsonal Gender X Human Values Environment 3 | nent√ ihip√ × Ethics√ s× × | SDG (Goals) | SDG3(Good health and well-being) SDG9(Industry Innovation and Infrastructure SDG12(Responsible consuption and produc | e) tion) | | | | |

| | | Part B | |
|---------|---|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Nutraceuticals and Functional Food: An Introduction, Definition; the link between nutrition and medicine; classical nutrients; phytochemicals and other dietary health factors for disease prevention. Applied aspects of the Nutraceutical Science | Lecture methods, ppt | 6 |
| 2 | Nutraceuticals: Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, dietary fibers, oligosaccharides and resistant starch, prebiotics, probiotics and synbiotics, Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers; their sources and role in promoting human health | Lecture methods, Quiz, Illustrate with analogies | 10 |
| 3 | Functional Foods: Types of functional foods- Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc), Fermented foods – their health benefits and role in promoting health. | Lecture methods, PPT, Expert Lecture | 11 |
| 4 | Future prospects:Research development and trends in processing of functional foods. Formulation and fabrication of functional foods. Legal Aspects: Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing, and regulatory issues related to nutraceuticals and functional foods. | Lecture methods, Audio/Video clips, group discussion, quiz | 10 |
| 5 | Anti-nutritional Factors present in Foods: Types of inhibitors present in various foods and how they can be inactivated. General idea about role of Probiotics and Prebiotics as nutraceuticals. Recent advances in techniques & feeding of substrates. Assessment of nutritional status and Recommended Daily allowances | Lecture methods, Group discussion, quiz | 8 |

Part C

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|---|--|---------------|-------|
| 1 | Estimation of ascorbic acid from lemon & amla juice by titration method | Experiments | BL4-Analyze | 2 |
| 2 | To determine the antioxidant potential of functional foods | Experiments | BL5-Evaluate | 2 |
| 3 | TLC separation of Plant pigments - Curcumin and carotene | Experiments | BL3-Apply | 2 |
| 4 | Estimation of crude fiber/pectic substances from plant material | Experiments | BL4-Analyze | 2 |
| 5 | Estimation of total phenols and chlorogenic acid (Phenolic compound) in plant materials and animal foods | Experiments | BL4-Analyze | 2 |
| 6 | To estimate cholesterol content in given sample by Lievermann-Burchard method | Experiments | BL4-Analyze | 2 |
| 7 | Qualitative test for tannins, phenolics and alkaloids using TLC | Experiments | BL5-Evaluate | 2 |
| 8 | To prepare functional foods from plant foods | PBL | BL6-Create | 2 |

| | Part D(Marks Distribution) | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|
| | Theory | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| 100 | 40 | 60 | 18 | 40 | 12 | | |
| | | | Practical | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| 100 | 50 | 60 | 30 | 40 | 20 | | |

| Books | |
|------------------|--|
| Articles | https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=f9c23dd60eea111659bd43b58ff763a70ff78824 |
| References Books | Handbook of Nutraceutical and Functional Foods-Wildman REC Innovations in Healthy and Functional Foods-Ghosh D Handbook of nutraceuticals Volume 2-Pathak YV |
| MOOC Courses | https://onlinecourses.swayam2.ac.in/ugc19_hs33/preview#:~:text=The%20online%20course%20on%20Functional,implications%20and%20mechanisms%20of%20action. |
| Videos | https://www.youtube.com/watch?v=R7BonXAiOE4&t=1s |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | - | - | - | 2 | 1 | 3 | 1 | 1 |
| CO2 | 2 | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 1 | 3 | 1 | 1 |
| CO3 | 1 | 3 | 1 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 1 | 1 |
| CO4 | 1 | 2 | 1 | 3 | 2 | 3 | 3 | 2 | - | - | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 1 | 1 | 3 | 3 | 3 | - | 3 | - | - | - | 3 | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Research | Methodology | | | | | | | | | | |
|------------------------------------|--|--|--|---|---|---|---|---|--|--|--|--|
| Course Code | BSMB 70 | 2 (T) | | | | | | | | | | |
| | | | | Part A | | | | | | | | |
| Voor | 4th | Somestor | Zth | Cradita | L | т | Р | С | | | | |
| Tear | 401 | Semester | 7.01 | Credits | 4 | 0 | 0 | 4 | | | | |
| Course Type | Theory only | | | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | | | |
| Pre-Requisite/s | Student s statistics | should have some basic | knowledge of | Co-Requisite/s | Should have understanding of the basic concepts of different types of research and their purposes | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- The CO2- The with its ap CO3- The verificatio CO4- The CO5- The | e course prepares the s e subject Research Met oplications in other field e course aims to provide or (BL2-Understand) e course aims to provide e course aims to provide | tudent to understand hodology is designed s.(BL2-Understand) e experimental basis, e basis of analyzing th e basis of experiment | the basic concepts of Research Methodology, for post graduate students of Biotechnology f and to enable students to acquire a specialize ne applications of Research Methodology in va al design, computer applications and use of st | its applications in o or describing the ba ed knowledge and u arious fields of rese latistical tools in res | experimental design asic concepts of each inderstanding of data arch and industries. earch and industries | and future prospects a and every division of a and its applications BL3-Apply) .(BL3-Apply) | (BL1-Remember) of the subject along in experimental | | | | |
| Coures Elements | Skill Deve Entreprer Employat Professor Gender > Human V Environm | elopment ✓ reurship X bility ✓ onal Ethics ✓ ć alues X rent X | SDG (Goals) | SDG4(Quality education) | | | | | | | | |

| | | Part B | |
|---------|---|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Introduction: Definition of Research, Qualities of Researcher, Components of Research Problem, Various Steps in Scientific Research, Types of Research; Hypotheses Research Purposes - Research Design - Survey Research, Research Reports. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 2 | Data Collection: Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire - Sampling Merits and Demerits - Experiments - Kinds - Procedure; Control Observation. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 3 | Introduction to Statistics - Probability Theories - Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test - Two Sample Tests / Chi-Square Test, t-test - Standard deviation. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 4 | Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 5 | Report Writing, Computer application: Use of computers for preparing and presenting Documents. Appropriate Statistical and other relevant packages, internet .Use of MS- Office | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |

| | Par | tC | | |
|---------|--|--|----------------|-------|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
| 1 | Steps in scientific research methodology | Case Study | BL2-Understand | 2 |
| 2 | Sampling process | Case Study | BL2-Understand | 2 |
| 3 | Developing Hypothesis | Case Study | BL2-Understand | 2 |
| 4 | Data collection | Case Study | BL3-Apply | 2 |
| 5 | Analysis of Variance | Case Study | BL3-Apply | 2 |
| 6 | Randomized Block Design | Case Study | BL4-Analyze | 2 |

| | Part D(Marks Distribution) | | | | | | | | | | | | | |
|---|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | | | |
| Total Marks Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation Min. Internal Evaluation | | | | | | | | | | | | | | |
| 100 | 40 | 40 | 12 | 60 | 30 | | | | | | | | | |
| | Practical | | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | | |
| 0 | | | | | | | | | | | | | | |

| Books | Research methodology, C. R. Kothari, 6th Edition |
|------------------|--|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037945/ |
| References Books | Research methodology, Panneerselvam, R., Prentice Hall of India, New Delhi |
| MOOC Courses | https://nptel.ac.in/courses/121106007 |
| Videos | https://nptel.ac.in/courses/121106007 |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 1 | - | - | - | - | - | - | 1 | 2 | - | - | - | - | - |
| CO2 | 1 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - |
| CO3 | 1 | 2 | - | - | - | - | - | - | 1 | 2 | - | - | - | - | - |
| CO4 | 1 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - |
| CO5 | 1 | 2 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Disaster Managemen | t | | | | | | | | | | |
|---|---|---|---|---|--------------|--------|---------|---|--|--|--|--|
| Course Code | BSMB VACIII (T) | | | | | | | | | | | |
| | | | Part A | | | | | | | | | |
| Vear | 2nd | Semester | 3rd | Credits | L | Т | Ρ | С | | | | |
| i cui | 2110 | Concestor | | Greats | 2 | 0 | 0 | 2 | | | | |
| Course Type | Theory only | | | | | | | | | | | |
| Course Category | Foundation core | oundation core | | | | | | | | | | |
| Pre-Requisite/s | To be familiar with the basics of natural disasters as well as anthropogenic factors and various approaches for disaster managements. | | | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To learn types of CO2- To understand CO3- To learn about CO4- To understand CO5- To apply the Na | of disasters and its profile in India(BL1-Rer the causes and impacts of disasters on env- risk reduction approaches of disasters with the concept of Disaster Management Cycle ational Acts and policies for mitigating disas | nember) irronment and related case studies of Glo safety issues in mitigating industrial disa and its Risk Reduction Measures(BL4 -/ ters, Role of Army, Police, Community, C | obal and National disasters. (BL2-Understand isters.(BL3-Apply) Analyze) Corporate, Media etc. for post Disaster Manage |) ement.(| BL5-Ev | aluate) | | | | | |
| Skill Development × SDG1(No poverty) Entrepreneurship × SDG4(Quality education) Entrepreneurship × SDG6(Clean water and sanitation) Professional Ethics ✓ SDG1(No poverty) Gender ✓ SDG4(Quality education) Human Values × SDG1(Responsible consuption a Environment ✓ | | | | | | | | | | | | |

| | | Part B | |
|---------|--|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Concepts and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks, Capacity buildings) Factors of disasters, Global trends in disaster: urban disasters, pandemics, complex emergencies, Climate change | lecture method, collaborative learning, group dicussions, field visit, | 8 |
| 2 | Classification of disaster: geophysical, hydrological, climatological, meteorological, biological and technological or man-made hazards. Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability. | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |
| 3 | Disaster management cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA). | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |
| 4 | Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |
| 5 | Disaster Management Indian scenario, India's vulnerability profile, Disaster Management Act 2005 and Policy guidelines, Environmental Legislation for Disaster Risk Management in India. Role of information technology in protecting environment and health. Role of NGOS Cases Studies: Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, South India Tsunami, Bihar floods, Plague Surat, COVID-19 pandemic | lecture method, collaborative learning, group dicussions, field visit,case studies | 8 |

Part D(Marks Distribution)

| | Theory | | | | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | | |
| 100 | 40 | 40 | 12 | 60 | | | | | | | | | | |
| | Practical | | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |

| | Part E |
|------------------|--|
| Books | • Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 • Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361] • Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011 • Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010. • Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3105552/ |
| References Books | Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. • Cuny, F. 1983. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development 2002. • Gout. of India: Disaster Management Act 2005, Government of India, 2009. National Disaster Management Policy. • Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009- 2012. • Disaster Madeical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003. • National Institute of Disaster Management • National Disaster Management • Intp://indm.gov.ini http://indm.gov.ini http://www.imd.gov.ini |
| MOOC Courses | https://nptel.ac.in/courses/124107010 |
| Videos | https://nptel.ac.in/courses/124107010 |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | - | - | - | - | 1 | 2 | - | - | - | - | 1 | - | - |
| CO2 | 1 | 2 | - | - | - | - | 1 | 2 | - | - | - | - | 1 | - | - |
| CO3 | 1 | 2 | - | - | - | - | 1 | 2 | - | - | - | - | - | - | - |
| CO4 | 1 | 2 | - | - | - | - | 1 | 2 | - | - | - | - | - | 2 | - |
| CO5 | 1 | 2 | - | - | - | - | 1 | 2 | - | - | - | - | - | - | 3 |
| CO6 | 1 | 2 | - | - | - | - | 1 | 2 | - | - | - | - | - | - | 3 |



Bsc_Microbiology

| Title of the Course | Plant Tissue Culture | | | | | | | | | | | |
|------------------------------------|---|--|--|--|-----|-----|---|---|--|--|--|--|
| Course Code | BSMB302(T) | | | | | | | | | | | |
| | | Part / | 4 | | | | | | | | | |
| Year | 2nd | Part A L Semester 3rd Credits L d 3rd 3rd 3rd 3rd the basic knowledge of plants, cell biology, botany and genetics. Co-Requisite/s call the basic terms, techniques, historical landmarks of plant tissue culture (BL1-Remember) tissue culture media using sterilization techniques for inoculation(BL2-Understand) | L | ΓP | , (| ; | | | | | | |
| | | | | | |) 1 | 4 | / | | | | |
| Course Type | Embedded theory and lab | nbedded theory and lab | | | | | | | | | | |
| Course Category | Disciplinary Major | sciplinary Major | | | | | | | | | | |
| Pre-Requisite/s | Should be acquainted with the bas | ic knowledge of plants, cell biology, | botany and genetics. | Co-Requisite/s | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To understand and recall the CO2- To prepare the plant tissue of CO3- To observe and differentiate CO4- To standardize the techniqu CO5- To develop in vitro regeneral | basic terms, techniques, historical ulture media using sterilization tech the behavior of various explants tov se and nutrient media for the growth ted and transgenic plantlets using va | landmarks of plant tissue culture(BL1-Remem niques for inoculation(BL2-Understand) vards the different types of nutrient media. (BL- and development of in vitro cultures. (BL3-Ap arious tools and techniques of plant tissue cult | ber) 4-Analyze) ply) ure.(BL6-Create) | | | | | | | | |
| Coures Elements | Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✓ Gender X Human Values X Environment X | | SDG (Goals) | SDG4(Quality education) | | | | | | | | |

| | | Part B | | | | | |
|---------|---|--|---|--|--|--|--|
| Modules | Contents | Pedagogy | | | | | |
| 1 | History: Important events and landmarks in the history of plant tissue culture. Introduction to cell and tissue culture, terms and definitions. Cellular Totipotency: Introduction cytodifferentiation, organ genic differentiation. Laboratory requirements and general techniques. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| 11 | Tissue culture media: Introduction, media constituents, types, selection, media preparation. Callus culture and its maintenance. Plant growth regulators. Cell and Suspension cultures, Somatic embryogenesis :Technique and application | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| 111 | Micropropagation in Plants, Acclimatization : Process and challenges. Haploid production:: Anther culture and embryo culture: Introduction, techniques, culture requirements and applications. Protoplast Culture: Protoplast isolation, culture and regeneration. Soma clonal Variation | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| IV | Somatic hybridization: technique and application Elicitors, Secondary metabolites and their production. Cryopreservation: technique and application | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| v | Plant cloning vectors and their applications. Agrobacterium mediated transformation in plants. Transgenic plants: technique and application. Application of plant tissue culture in agriculture and forestry. Concept of Intellectual property right (IPR) | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 9 | | | | |

| Part C | | | | | | | | | | | | |
|---------|--|--|----------------|-------|--|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | | |
| I | Plant tissue culture: Applications and commercial importance | Experiments | BL2-Understand | 2 | | | | | | | | |
| 11 | Laboratory design and set up of plant tissue culture unit. | Experiments | BL2-Understand | 2 | | | | | | | | |
| ш | Preparation of culture media. | Experiments | BL3-Apply | 2 | | | | | | | | |
| IV | Surface sterilization, sealing of culture, sources of contamination and their check measures | Experiments | BL3-Apply | 3 | | | | | | | | |
| v | Sterilization of media and apparatus. | Experiments | BL3-Apply | 2 | | | | | | | | |
| VI | Collection and preparation of explants | Experiments | BL4-Analyze | 2 | | | | | | | | |
| VII | Preparation of MS media for the inoculation of seeds. | Experiments | BL3-Apply | 2 | | | | | | | | |
| VIII | To establish seeds cultures | PBL | BL6-Create | 2 | | | | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | | | |
| | | | Practical | · | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | | | | |

| Part E | | | | | | | | | |
|------------------|--|--|--|--|--|--|--|--|--|
| Books | Razdan M.K.;An Introduction to Plant Tissue Culture;3rd Edition Smith.R, Plant Tissue Culture: Techniques and Experiments. Academic Press, 2012 | | | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7356144/ https://link.springer.com/article/10.1007/s11627-022-10301-9 | | | | | | | | |
| References Books | Bhojwani S.S & Razdan.M.K;Plant Tissue Culture; 5th Edition Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 1: Principles and Development. Springer. 2010. Kole, C., Michler, C., Abbott, A.G., Hall, T.C. (Eds.) Transgenic Crop Plants: Volume 2: Utilization and Biosafety. Springer. 2010. | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102103016 | | | | | | | | |
| Videos | https://nptel.ac.in/courses/102103016 | | | | | | | | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 1 | 2 | - | 2 | 2 | - | - | - | 2 | - | - | 1 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | - | - | 1 | - | 3 |
| CO3 | 3 | 1 | 1 | - | 1 | 1 | - | - | - | - | - | - | 3 | 2 | 3 |
| CO4 | 2 | 2 | - | 2 | 1 | 1 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO5 | 3 | 2 | - | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Genetic Engine | Genetic Engineering, Tools and applications | | | | | | | | | | |
|------------------------------------|--|---|---|--|--|---|---|---|--|--|--|--|
| Course Code | BSMB401(T) | 3SMB401(T) | | | | | | | | | | |
| Part A | | | | | | | | | | | | |
| Voor | and | Somester | 4th | Cradita | L | т | Р | С | | | | |
| Tear | 2110 | Semester | 401 | Credits | 3 | 0 | 1 | 4 | | | | |
| Course Type | Embedded the | Embedded theory and lab | | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | | | |
| Pre-Requisite/s | Student must h information | ave the detailed knowledge of G | ene expression and hereditary | Co-Requisite/s | Detailed study of genomics, proteomics and metabolomics tool | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To rement CO2- To unders CO3- To unders CO4- To evalua CO5- To apply | nber the role of all the enzymes u stand the method of creating new stand the importance Nucleic aci ate the applications of in various of the understanding of creation of | used in the DNA editing(BL1-Re v molecules such as DNA & RN/ d editing tools(BL2-Understand fields such as research, Agricult new DNA, RNA & Protein and it | member) \(BL2-Understand))) ure, Pharmaceutical industries(BL5-Evaluate s use in different Fields.(BL3-Apply) |) | | | | | | | |
| Coures Elements | Skill Developm Entrepreneursh Employability ✓ Professsonal E Gender ✓ Human Values Environment X | ent ✓ hip ✓ ′ thics ✓ X | SDG (Goals) | SDG4(Quality education) | | | | | | | | |

| | | Part B | | | | | |
|---------|---|--|---|--|--|--|--|
| Modules | Contents | Pedagogy | | | | | |
| 1 | Introduction to gene cloning and its necessity: DNA modifying enzymes: Restriction enzymes (RE)- structure function and types, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc Cloning methods. linkers and adaptors. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| 2 | Methods of introduction of DNA into living cells, E.coli, plant and animal cells, Genetic transformation in plants:Agrobacteriun mediated transformation in plants,structure and features of Ti and Ri plasmids.Genomic libraries and cDNA libraries. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| 3 | Cloning vectors: Plasmids and Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC and YAC) for E.coli, yeast. Strategies for identification of recombinant clones containing cloned genes: Nucleic acid hybridization, immune screening etc. Expression vectors for E.coli andYeast. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| 4 | Tools for RDT: Restriction mapping, Southern and northern blotting, Forensic application of biotechnology: DNA fingerprinting and its applications, forensic medicine Molecular Pharming: Application | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |
| 5 | Applications of RDT, Production of recombinant protein (Insulin, Growth hormone), production of Recombinant vaccine. Golden rice, Artifical seed production, biofertilizers and biopesticide production GM crops and GM food | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 | | | | |

| | Part C | | | | | | | | | | | | |
|---------|---|--|---------------|--------|--|--|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | | | |
| 1 | Preparation of stock and buffer solutions for DNA isolation | Experiments | BL3-Apply | 2 | | | | | | | | | |
| 2 | Isolation of DNA from yeast cells. | Experiments | BL3-Apply | 2 | | | | | | | | | |
| 3 | Isolation of DNA from Plant cell. | Experiments | BL3-Apply | 2 | | | | | | | | | |
| 4 | Isolation of plasmid DNA | Experiments | BL3-Apply | 2 | | | | | | | | | |
| 5 | Agarose gel electrophoresis of Genomic DNA | Experiments | BL4-Analyze | 2 | | | | | | | | | |
| 6 | Isolation of RNA | Experiments | BL4-Analyze | 2 | | | | | | | | | |
| 7 | Quantification of DNA by spectrophotometer(260/280nm) | Experiments | BL4-Analyze | 2 | | | | | | | | | |
| 8 | To isolate the Auxotrophic mutants from the mixed culture sample of Microorganism | PBL | BL5-Evaluate | 3 days | | | | | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | | |
| | | | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 50 | 60 | 30 | 40 | 20 | | | | | | | |

| Part E | | | | | | | | |
|------------------|---|--|--|--|--|--|--|--|
| Books | TA Brown, Gene cloning 4 edition | | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078015/ | | | | | | | |
| References Books | James D watson.Molecular Biology Of gene, 4 edition | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102103074 | | | | | | | |
| Videos | https://nptel.ac.in/courses/102103074 | | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | 1 | 1 | 2 |
| CO2 | 1 | 2 | 3 | - | - | 3 | 2 | - | - | - | - | - | 2 | - | - |
| CO3 | 1 | 2 | 3 | - | - | 1 | 1 | - | - | - | - | - | - | 2 | 1 |
| CO4 | 1 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | 2 | - | 3 |
| CO5 | 1 | 2 | 3 | - | - | 2 | - | - | - | - | - | - | 2 | - | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_Biotechnology

| Title of the Course | Genetic E | Engineering | | | | | | | | | |
|------------------------------------|---|--|--|--|--|-----------|---|---|--|--|--|
| Course Code | BT 301 (| T) | | | | | | | | | |
| | | | | Part A | | | | | | | |
| Voor | 2nd Somester | | 0.4 | Credite | L | т | Р | С | | | |
| Teal | 2110 | Semester | 510 | Creuits | 4 | 0 | 0 | 4 | | | |
| Course Type | Embedde | Embedded theory and lab | | | | | | | | | |
| Course Category | Discipline | Discipline Core | | | | | | | | | |
| Pre-Requisite/s | knowledge of DNA RNA structure and mutation types in DNA | | | Co-Requisite/s | Effects of Changes in DNA on cell and Protein formation and use of different proteins in Health and Medicine Industry | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To CO2- To CO3- To CO4- To CO5- To | remember the role of understand the metho understand the import apply the understandi evaluate the application | all the enzymes use od of creating new m tance Nucleic acid e ing of creation of new ons of in various field | d in the DNA editing(BL1-Remember) olecules such as DNA & RNA(BL2-Understa iditing tools (BL2-Understand) w DNA, RNA & Protein and its use in different ds such as research, Agriculture, Pharmaceut | nd) Fields.(BL3-Apply) ical industries(BL5- | Evaluate) | | | | | |
| Coures Elements | Skill Dev Entrepre Employa Professs Gender 2 Human V Environn | elopment ✓ neurship X bility ✓ onal Ethics ✓ X /alues X nent ✓ | SDG (Goals) | SDG4(Quality education) SDG8(Decent work and economic growth) | | | | | | | |
| | | | | Part B | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|--|---|-------|
| 1 | Essential enzymes used in r-DNA technology, Types of Restriction enzymes and their mechanism, Restriction modification system. Cloning vectors- Plasmids, Cosmids, Phagmids, Phasmids, Artificial hromosomes (YAC and BAC), Shuttle vectors, Expression vectors, for E.coli, Hybrid Plasmid and phage vectors. Host organism used for expression system | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 2 | Genetic transformation in plants:Agrobacteriun mediated transformation in plants, crown gall and hairy root producing strains, structure and features of Ti and Ri plasmids, mechanisms of DNA transfer. Recalcitrance of monocot for Agrobacteriun mediated transformation. Ti and Ri plasmid based vectors, Binary vectors, use of 35SCaMV and other promoters, selectable marker, Reporter genes. Methods of direct DNA transfer, particle bombardment, electroporation, Microinjection. Transfection, Alternative DNA transfer methods | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 3 | Strategies for development of Tolerant/Resistant plants and their utility for productivity and performance: Herbicide resistance (Glyphosate, phosphoinothricin, Sulfonylurea, Atrazine). Insect resistance: Bt Genes, Non-Bt like protease inhibitors, Alpha amylase inhibitor, Trypsin inhibitor; Genitically modifies plants: Examples, Advatages and disadvantages | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures | 8 |
| 4 | Gene therapy: types of gene therapy, Strategies of gene delivery, Gene replacement/augmentation, gene therapy for cancer cells, Gene silencing. RNA interference; Si RNA and mi RNA. DNA fingerprinting and its applications Human genome project: Objective and goals. Protein engineering : examples and application | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lectures | 8 |
| 5 | Applications of r-DNA technology in health, agriculture, industrial sectors and pharmaceuticals. Molecular Farming: Pharming in animals and plants, Nutritional quality: golden rice, protein, vitamins. Archeogenetics: Introduction and application | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |

| | Pai | tC | | |
|---------|---|--|----------------|-------|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
| 1 | Preparation of stock and buffer solutions for DNA isolation | Experiments | BL2-Understand | 3 |
| 2 | Isolation of DNA from yeast cells. | Experiments | BL3-Apply | 3 |
| 3 | Isolation of DNA from Plant cell. | Experiments | BL3-Apply | 3 |
| 4 | Isolation of plasmid DNA | Experiments | BL3-Apply | 3 |
| 5 | Agarose gel electrophoresis of Genomic DNA | Experiments | BL5-Evaluate | 3 |
| 6 | Quantification of DNA by spectrophotometer(260/280nm) | PBL | BL2-Understand | 6 |
| 7 | Isolation of RNA from Yeast cell | PBL | BL3-Apply | 3 |

| | Part D(Marks Distribution) | | | | | | | | | | | |
|-------------|---|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks External Evaluation | | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | | |
| | | · | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 0 | 40 | 20 | 60 | 30 | | | | | | | |

| Part E | | | | | | | | | |
|------------------|---|--|--|--|--|--|--|--|--|
| Books | TA Brown Gene cloning 4th Edition | | | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3078015/ | | | | | | | | |
| References Books | Waston J.D. Molecular Biology of the Gene: 4th Edition Primrose and Twyman Principles of Gene Manipulation and Genomics 8th Edition | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102103074 | | | | | | | | |
| Videos | https://nptel.ac.in/courses/102103074 | | | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 1 | - | - | - | 2 | 1 | - | - | - | - | 1 | 1 | 3 |
| CO2 | 1 | 2 | 2 | - | - | - | 2 | 1 | - | - | - | - | 2 | 1 | 2 |
| CO3 | 2 | 3 | 2 | - | - | - | 1 | 2 | - | - | - | - | 2 | 1 | 2 |
| CO4 | 2 | 3 | 1 | - | - | - | 2 | 2 | - | - | - | - | 3 | 2 | 2 |
| CO5 | 3 | 1 | 3 | - | - | - | 3 | 3 | - | - | - | - | 3 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_Biotechnology

| Title of the Course | Agriculture Biotechn | ology and IPR | | | | | | | | | | |
|------------------------------------|---|--|--|---|---------|----------------|-----------|--------|--|--|--|--|
| Course Code | BT 305 (T) | | | | | | | | | | | |
| | -j | | Part A | | | | | | | | | |
| Year | 2nd | Semester | 3rd | Credits | L 4 | T O | P 0 | C 4 | | | | |
| Course Type | Theory only | Theory only | | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | | | |
| Pre-Requisite/s | Student should have | Co-Requisite/s | | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To define and CO2- To understand CO3- To define the CO4- To apply the k CO5- The students use(BL4-Analyze) | contrast the terms agriculture and agricult if the techniques, skills, and modern engin concept of ultilizing plants for production of nowledge of engineering principles of agri will be able to develop the relationship bet | ural biotechnology(BL1-Remember) pering tools necessary for engineering p vaccines and production of biofertilizers culture biotechnology to living entities fo ween science and society and will be ab | ractice in agriculture biotechnology(BL2-Unde (BL2-Understand) r societal welfare(BL3-Apply) le to give justification for biotechnological mar | erstand |) n of plan | ts for hu | man | | | | |
| Coures Elements | Skill Development Entrepreneurship ✓ Employability ✓ Professonal Ethics Gender X Human Values ✓ Environment ✓ | 4 | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) | | | | | | | | |

Part B Modules Contents Pedagogy Hours Introduction To Agricultural Biotechnology: Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre-modern India. Review of plant cell structure and function; Review of water uptake Introduction to plant nutrition; Mineral availability- uptake of minerals I Lecture method, demonstrations, field visit, ABL, Case studies, ABL. 8 Methods of breeding self-pollinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Photoperiodism and its significance; Vernalization and hormonal control. Heterosis-Genetic and Molecular basis, Apomixis -Mechanism and significance in crop improvement Ш 9 Lecture method, demonstrations, field visit, ABL, Case studies, ABL. Post Harvest Biotechnology: Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening- changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spollage of fruit and vegetable, Microbial contaminants and post-harvest pathology ш Lecture method, demonstrations, field visit, ABL, Case studies, ABL. 8 Biotechnology In Organic Farming: Organic farming, principles and its scope in India; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Molecular Farming And Nitrogen Fixation: Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Metabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc.,. IV Lecture method, demonstrations, field visit, ABL, Case studies, ABL. 9 Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR, International Regime Relating to IPR TRIPS and other Treaties (WIPO,WTO, GATTS) V 8

| ганс |
|---------|
| 1 411 4 |

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|--|--|---------------|---------|
| I | To analyze the soil samples of various locations to check it sfertility. | PBL | BL4-Analyze | 1 week |
| 11 | To study the mechanism and significance in crop improvement. | Industrial Visit | BL4-Analyze | 8 hrs |
| Ш | To apply for the patent for a specific product, product developement process or any idea | PBL | BL6-Create | 15 days |

| | | | Theory | | | | | | |
|-------------|-----------------------|--|--------------------------|---------------------|--------------------------|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation Min. External Evaluation | | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | |
| | | | Practical | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| | | | | | | | | | |

Part D(Marks Distribution)

| | Parte | | | | | | | | | |
|------------------|--|--|--|--|--|--|--|--|--|--|
| Books | MS Swamynathan,Biotechnology in Agriculture, a Dialogue,1981 Arun K. Sharma,Hand book of organic farming Agrobios,2002 | | | | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8751662/ | | | | | | | | | |
| References Books | Arie Altman Paul Hasegawa,Plant Biotechnology and Agriculture,2011 K. Lindsey and M.G.K. Jones,Plant biotechnology in Agriculture, 1989 | | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128 | | | | | | | | | |
| Videos | https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128 | | | | | | | | | |

Part F

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | 2 | 3 | 2 |
| CO2 | 1 | - | 2 | 3 | - | 3 | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO3 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 |
| CO4 | 2 | 1 | 2 | 2 | 1 | - | 2 | - | - | - | - | - | 2 | 2 | 1 |
| CO5 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | - | - | - | - | - | 3 | 2 | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_Biotechnology

| Title of the Course | Stem cell biology | em cell biology | | | | | | | | | | | |
|------------------------------------|--|---|--|---|----------|----|---|---|--|--|--|--|--|
| Course Code | BT-205 (T) | 205 (T) | | | | | | | | | | | |
| | | | Part A | | | | | | | | | | |
| Veer | 1.01 | Someeter | Ond | Credite | L | т | Р | С | | | | | |
| Tear | ist | | | | 4 | 0 | 0 | 4 | | | | | |
| Course Type | Theory only | Theory only | | | | | | | | | | | |
| Course Category | Discipline Core | Discipline Core | | | | | | | | | | | |
| Pre-Requisite/s | Knowledge about | basics of cell | | Co-Requisite/s | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To remember CO2- To understa CO3- To apply the CO4- To interpret CO5- To Justify th | er the basics of stem cell structure and p nd the techniques involved in the culturir b bioengineering and development of ma the various applications of stem cells in 1 e industrial approach to stem cells. Ethic | roperties.(BL1-Remember) g of functional stem cell.(BL2-Unders mmalian stem cells in the laboratory(B reating various diseases(BL4-Analyze al and Legal issues: and Guidelines in | tand) L3-Apply)) conducting human stem cell research.(BL5-E | Evaluate | •) | | | | | | | |
| Coures Elements | Skill Development Entrepreneurship Employability ✓ Professsonal Ethi Gender X Human Values X Environment X | t√ × cs√ | SDG (Goals) | SDG4(Quality education) | | | | | | | | | |

| | | Part B | |
|---------|---|---|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Basic of biology of stem cells; Unique properties of stem cells. Types & sources of stem cells: embryonic, fetal, cord blood, placenta, adult, bone marrow: hematopoietic and Mesenchymal stem cells. Organ Derived Stem cells, Cancer stem cells, induced pluripotent stem cells, Stem cell banking. | Lecture menthod, demonstrations, experiment, ABL, PBL, case studies | 8 |
| 2 | Stem cell characterizations: Bone Marrow Mesenchymal Stem Cells, Hematopoietic Stem Cells isolation & characterizations, markers & their identification. Blood cell formation from Bone marrow stem cell. | Lecture menthod, demonstrations, experiment, ABL, PBL, case studies | 8 |
| 3 | Growth factor requirement and stem cell maintenance in in-vitro culture. Bone marrow transplantation versus Stem cell transplantation. Stem Cells and Cloning, Molecular basis of stem cell self-renewal, pluripotency, and differentiation, Metaplasia, and trans- differentiation | Lecture menthod, demonstrations, experiment, ABL, PBL, case studies | 8 |
| 4 | Role of signal transduction pathways in self-renewal and differentiation of stem cells. Cell cycle regulators in stem cells. Therapeutic application of stem cells: Current State and Future Perspectives, Neurodegenerative diseases, Spinal cord injury, Heart disease, Diabetes, Burns and Skin ulcers, Muscular Dystrophy. | Lecture menthod, demonstrations, experiment, ABL, PBL, case studies | 8 |
| 5 | Orthopedic applications, Stem cells, and gene therapy. An industrial approach to stem cells. Ethical and Legal Issues: ICMR DBT Guidelines in conducting human stem cell research | Lecture menthod, demonstrations, experiment, ABL, PBL, case studies | 8 |

Part C

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|---|--|----------------|-------|
| 1 | To study the basic features of stem cell | Experiments | BL2-Understand | 2 |
| 2 | Study of stem cells preserved under in vitro conditions | PBL | BL4-Analyze | 3 |

| | Part D(Marks Distribution) | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | | |
| | · | | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| | 0 | | | | | | | | | | | |

| Part E | | | | | | | | | |
|------------------|--|--|--|--|--|--|--|--|--|
| Books | R. Lanza, I. Weissman, J. Thomson, and R. Pedersen, 1. Handbook of Stem Cells, Two Volume, Volume 1-2: Volume 1-Embryonic Stem Cells; Volume 2-Adult&Fetal Stem Cells, 2012, Academic Press. Volume, Volume 1-2: V | | | | | | | | |
| Articles | https://www.mdpi.com/2306-5354/8/5/50 | | | | | | | | |
| References Books | R.Lanza, J.Gearhartetal (Ed), Elsevier Academic press. Essentials of Stem Cell Biology, 1 Elsevier Academic press. Engineering & Regenerative Medicine" 2008, Artech House. INC Publications. NaggyN. Habib, M.Y.Levicar, L.G. Jiao and N. Fisk: Stem Cell Repair and Regeneration. Volume- 2,2007, Imperial College Press Volume 2, 2007, Imperial College Press | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102106035 | | | | | | | | |
| Videos | https://nptel.ac.in/courses/102106035 | | | | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | - | - | - | 2 | 2 | - | - | - | 2 | - | - | 1 | - | 1 |
| CO2 | 2 | 3 | 2 | 2 | 2 | 1 | - | - | - | 2 | - | - | 1 | - | 3 |
| CO3 | 3 | 1 | 1 | 2 | 1 | - | - | - | - | - | - | - | 3 | 2 | 3 |
| CO4 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | 2 | - | - | 2 | 3 | 2 |
| CO5 | 2 | 1 | 1 | 2 | 1 | - | - | - | - | 2 | - | - | 2 | 2 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_Biotechnology

| Title of the Course | Bioprocess Engi | neering | | | | | | | | | | |
|---|---|---|---|---|--|--|---------------|---------|--|--|--|--|
| Course Code | BT304 (T) | 3T304 (T) | | | | | | | | | | |
| | | | Part A | | | | | | | | | |
| Vaar | Ond | Samaatar | 0-4 | Credite | L | т | Р | С | | | | |
| Tear | 2110 | Semester | 310 | Credits | 3 | 0 | 1 | 4 | | | | |
| Course Type | Theory only | Theory only | | | | | | | | | | |
| Course Category | Discipline Core | iscipline Core | | | | | | | | | | |
| Pre-Requisite/s | Should be famili the production, p metabolites with | ar with the basics of Bioprocess Eng purification and transport of metaboli the help of microbes and their kinet | jineering, techniques used for tes, production of different ics. | Co-Requisite/s | Co-Requisite/s Should have the different fermentation processes, transport phenomenon and production of some important industrial metabolites | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- The cours CO2- The subject along with its ap CO3- The cours CO4- The cours CO5- The cours | e prepares the student to understan ct Bioprocess Engineering is design plications in other fields. (BL2-Und e aims to provide experimental basis e aims to provide basis of analyzing e aims to provide basis of design, pr | d the basic concepts of Bioproces ed for post graduate students of ts rstand) s, and to enable students to acqu the applications of Bioprocess Er oduction and purification of biopr | ss Engineering, its applications and future pro iotechnology for understanding of basic conc- ire a specialized knowledge and understandir igineering in various fields of research and in oducts produced through research and in indi | spects. (BL1 epts of each Ig. (BL3-App dustries (BL3 ustries. (BL3 | -Remember and every di bly) 3-Apply) -Apply) | vision of the | subject | | | | |
| Skill Development ✓ Entrepreneurship ✓ Employability ✓ SDG (Goals) SDG2(Zero hunger) SDG3(Good health and well-being) SDG4(Quality education) SDG4(Quality education) SDG8(Decent work and economic growth) | | | | | | | | | | | | |
| | | | Part B | | | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|---|--|-------|
| 1 | Units and dimensions: dimensional analysis, stiochiometric and composition relationship, Newton's law of viscosity and its measurement. Introduction to bioprocess technology Isolation and screening of Industrial microorganisms, Preservation and maintenance of industrial microorganisms | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 2 | Kinetics of microbial growth, death and product synthesis; Air and media sterilization, Construction, design and types of bioreactor. Kinetics of batch, fed batch and continuous reactor. Automation for monitoring and control | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 3 | Transport phenomenon in biochemical engineering: Mass transfer, heat transfer, rheology, Aeration and agitation. Product recovery processes, centrifugation, chromatography, extraction process, crystallization, drying and packaging. Quality assurance and safety consideration in DSP, Bioprocess Economics. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| 4 | Microbial production of Antibiotics (Penicillin and Streptomycin) and Enzymes (Amylase, Protease) with applications. Microbial Production of Vitamin (Vitamin B12), amino acids (Glutamic acid). | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, Video lecture | 8 |
| 5 | Microbial production of Organic acids (Citric acid and Acetic Acid), solvents (Ethanol and acetone). Microbial production of food-SCP. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |

| | Part C | | | | | | | | | | | | |
|---------|--|--|---------------|-------|--|--|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | | | |
| 1 | Isolation of industrially important microbes from soil by serial dilution method | Experiments | BL3-Apply | 3 | | | | | | | | | |
| 2 | Isolation of industrially important microbes from water | Experiments | BL3-Apply | 3 | | | | | | | | | |
| 3 | Isolation of industrially important microbes from air | Experiments | BL3-Apply | 3 | | | | | | | | | |
| 4 | Microbial production of ethanol from orange juice using S. Cereviseae | Experiments | BL4-Analyze | 3 | | | | | | | | | |
| 5 | Microbial production of ethanol from pineapple juice using S. Cereviseae | Experiments | BL3-Apply | 3 | | | | | | | | | |
| 6 | Microbial production of ethanol from grape juice using S. Cereviseae | Experiments | BL3-Apply | 3 | | | | | | | | | |
| 7 | Microbial production of citric acid using Aspergillus niger | Experiments | BL3-Apply | 3 | | | | | | | | | |
| 8 | Microbial production of acetic acid | Experiments | BL3-Apply | 3 | | | | | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | 20 | | | | | | | |
| | | | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 40 | 12 | 60 | 30 | | | | | | | |

| Books | Bioprocess Enga, Principles, P.M. Doran, Elsevier. | | | | | |
|--|--|--|--|--|--|--|
| Articles https://www.researchgate.net/topic/Bioprocess-Engineering | | | | | | |
| References Books | Bioprocess Engg., Schular, Kargi | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102106022 | | | | | |
| Videos | https://nptel.ac.in/courses/102106022 | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 | - |
| CO2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO3 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO4 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO5 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_Biotechnology

| Title of the Course | Research Project | | | | | | | | |
|------------------------------------|--|--|------------------|--|---|---|----|----|--|
| Course Code | BT401 | | | | | | | | |
| | Part A | | | | | | | | |
| Voar | 2nd | Somostor | 4th | Credite | L | Т | Ρ | С | |
| i eai | 2110 | Semester | 401 | oreans | 0 | 0 | 14 | 14 | |
| Course Type | Project | | | | | | | | |
| Course Category | Projects and Internship | | | | | | | | |
| Pre-Requisite/s | Student must have | e basic knowledge of biotechnological la | aboratory skills | Co-Requisite/s | | | | | |
| Course Outcomes & Bloom's Level | C01- To provide students with the fundamental tools and practical skills required to generate competent and highly qualified post graduates. (BL2-Understand) C02- To acquain the students with the principles of biosafety and ethical perspectives of biotechnological systems. (BL2-Understand) C03- To develop students' ability to apply knowledge and skills to solve theoretical and practical problems in biology and biotechnology.(BL5-Evaluate) C04- To provide students' ability to apply knowledge and skills to solve theoretical and practical problems in biology and biotechnology. (BL5-Evaluate) C04- To provide students with the basis for the life-long self-learning in an attempt to keep up with the continuous quick changes in the field of biotechnology. (BL3-Apply) C05- To equip students with the necessary critical theoretical background, develop the analytical, and basic research skills that will help students to pursue higher education in reputed institutes at both national and international levels/BL4-Analyze) | | | | | | | | |
| Coures Elements | Skill Development Entrepreneurship Employability ✓ Professsonal Ethic Gender × Human Values × Environment × | .√ X ≈s √ | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) | | | | | |
| | | | Part B | | | | | | |
| Modules | | Contents | Pedagogy | Pedagogy Hours | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| | Theory | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| | 100 | | | | | | | | | |
| | | • | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 200 | 0 | 200 | 100 | | | | | | | |

| | Part E | | | | | | | | |
|------------------|--------|--|--|--|--|--|--|--|--|
| Books | | | | | | | | | |
| Articles | | | | | | | | | |
| References Books | | | | | | | | | |
| MOOC Courses | | | | | | | | | |
| Videos | | | | | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 2 | 1 | - | 1 | 1 | - | 1 | - | - | - | - | - | - | 2 | 2 |
| CO2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 1 |
| CO3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO4 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | - | - | - | - | - | 1 | 1 | 1 |
| CO5 | 3 | - | 1 | 1 | - | - | 2 | - | - | - | - | - | 1 | 3 | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Agriculture Biotechnology and Intellectual property rights | | | | | | | | | |
|------------------------------------|---|--|----------------|---|--|--|--|--------|--|--|
| Course Code | DSE II (T) | | | | | | | | | |
| <u> </u> | | | Part A | | | | | | | |
| Year | 3rd Semester 6th Credits L 3 | | | | | | | C 3 | | |
| Course Type | Theory only | Theory only | | | | | | | | |
| Course Category | Discipline Specific Elective | | | | | | | | | |
| Pre-Requisite/s | Student should ha | ve basic knowledge of botany and genetic e | Co-Requisite/s | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To define and contrast the terms agriculture and agricultural biotechnology(BL1-Remember) CO2- To understand the techniques, skills, and modern engineering tools necessary for engineering practice in agriculture biotechnology(BL2-Understand) CO3- To define the concept of utilizing plants for production of vaccines and production of biofertilizers(BL2-Understand) CO4- To apply the knowledge of engineering principles of agriculture biotechnology to living entities for societal welfare(BL3-Apply) CO5- The students will be able to develop the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use(BL4-Analyze) | | | | | | | | | |
| Coures Elements | Skill Development Entrepreneurship Employability ✓ Professsonal Ethic Gender X Human Values ✓ Environment ✓ | √ √ ≫ √ | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) | | | | | | |

| | | Part B | |
|---------|--|--|-------|
| Modules | Contents | Pedagogy | Hours |
| I | Introduction To Agricultural Biotechnology: Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre- modern India. Review of plant cell structure and function; Review of water uptake Introduction to plant nutrition; Mineral availability- uptake of minerals | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 8 |
| н | Methods of breeding self-pollinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Photoperiodism and its significance; Vernalization and hormonal control. Heterosis-Genetic and Molecular basis, Apomixis -Mechanism and significance in crop improvement | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 9 |
| ш | Post Harvest Biotechnology: Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening; changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable, Microbial contaminants and post-harvest pathology | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 8 |
| IV | Biotechnology In Organic Farming: Organic farming, principles and its scope in India; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Molecular Farming And Nitrogen Fixation: Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Netabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc.,. | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 9 |
| v | Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR, International Regime Relating to IPR TRIPS and other Treaties (WIPO,WTO, GATTS) | | 8 |

| | Pa | tC | | |
|---------|--|--|---------------|---------|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
| I | To analyze the soil samples of various locations to check it sfertility. | PBL | BL4-Analyze | 1 week |
| 11 | To study the mechanism and significance in crop improvement. | Industrial Visit | BL4-Analyze | 8 hrs |
| Ш | To apply for the patent for a specific product, product developement process or any idea | PBL | BL6-Create | 15 days |

| | Part D(Marks Distribution) | | | | | | | | | |
|-------------|----------------------------|---|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Theory | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | Minimum Passing Marks External Evaluation | | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | |
| | | · | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | |

| | Part E | | | | | | | | |
|------------------|--|--|--|--|--|--|--|--|--|
| Books | MS Swamynathan,Biotechnology in Agriculture, a Dialogue,1981 Arun K. Sharma,Hand book of organic farming Agrobios,2002 | | | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8751662/ | | | | | | | | |
| References Books | Arie Altman Paul Hasegawa,Plant Biotechnology and Agriculture,2011 K. Lindsey and M.G.K. Jones,Plant biotechnology in Agriculture, 1989 | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128 | | | | | | | | |
| Videos | https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128 | | | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | 2 | 3 | 2 |
| CO2 | 1 | - | 2 | 3 | - | 3 | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO3 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 |
| CO4 | 2 | 1 | 2 | 2 | 1 | - | 2 | - | - | - | - | - | 2 | 2 | 1 |
| CO5 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | - | - | - | - | - | 3 | 2 | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Agriculture Biotech | Agriculture Biotechnology and Intellectual property rights | | | | | | | | | |
|------------------------------------|---|--|-------------|---|---|---|---|---|--|--|--|
| Course Code | DSE II (T) | | | | | | | | | | |
| Part A | | | | | | | | | | | |
| Year | 3rd | Semester | 6th | Credits | L | Т | Р | С | | | |
| | | | | | 3 | 0 | 0 | 3 | | | |
| Course Type | Theory only | heory only | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | | |
| Pre-Requisite/s | Student should have basic knowledge of botany and genetic engineering Co-Requisite/s | | | | | | | | | | |
| Course Outcomes & Bloom's Level | C01- To define and contrast the terms agriculture and agricultural biotechnology(BL1-Remember) C02- To understand the techniques, skills, and modern engineering tools necessary for engineering practice in agriculture biotechnology(BL2-Understand) C03- To define the concept of utilizing plants for production of vaccines and production of biofertilizers(BL2-Understand) C04- To apply the knowledge of engineering principles of agriculture biotechnology to living entities for societal welfare(BL3-Apply) C05- The students will be able to develop the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use(BL4-Analyze) | | | | | | | | | | |
| Coures Elements | Skill Development Entrepreneurship ✓ Employability ✓ Professsonal Ethic Gender X Human Values ✓ Environment ✓ | √ √ ≫s √ | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) | 3DG3(Good health and well-being) 3DG4(Quality education) | | | | | | |

| | | Part B | |
|---------|--|--|-------|
| Modules | Contents | Pedagogy | Hours |
| I | Introduction To Agricultural Biotechnology: Origin of cultivated plants and plant indication, Introduction to Indian Agriculture heritage; Soil management and its relevance in Pre- modern India. Review of plant cell structure and function; Review of water uptake Introduction to plant nutrition; Mineral availability- uptake of minerals | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 8 |
| Ш | Methods of breeding self-polinated and vegetatively propagated plants; Seed Germination and Seedling Growth; Photoperiodism and its significance; Vernalization and hormonal control. Heterosis-Genetic and Molecular basis, Apomixis -Mechanism and significance in crop improvement | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 9 |
| ш | Post Harvest Biotechnology: Importance of post harvest physiology; Stages of growth; Maturity indices; Fruit ripening: changes during ripening; Post harvest losses-types; Technologies to control post harvest losses; Respiration and transpiration loss, methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable, Microbial contaminants and post-harvest pathology | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 8 |
| IV | Biotechnology In Organic Farming: Organic farming, principles and its scope in India; Role of Biotechnology in organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Molecular Farming And Nitrogen Fixation: Molecular farming for the production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; Metabolic engineering of plants for the production of fatty acids, industrial oils, flavonoids etc.,. | Lecture method, demonstrations, field visit, ABL, Case studies, ABL. | 9 |
| v | Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR, International Regime Relating to IPR TRIPS and other Treaties (WIPO,WTO, GATTS) | | 8 |

| | Part C | | | | | | |
|---------|--|--|---------------|---------|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | |
| 1 | To analyze the soil samples of various locations to check it sfertility. | PBL | BL4-Analyze | 1 week | | | |
| 11 | To study the mechanism and significance in crop improvement. | Industrial Visit | BL4-Analyze | 8 hrs | | | |
| Ш | To apply for the patent for a specific product, product developement process or any idea | PBL | BL6-Create | 15 days | | | |

| Part D(Marks Distribution) | | | | | | | |
|----------------------------|--|--|--|---|--|--|--|
| Theory | | | | | | | |
| Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | |
| 40 | 60 | 18 | 40 | | | | |
| Practical | | | | | | | |
| Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | |
| | Minimum Passing Marks 40 Minimum Passing Marks | Part Minimum Passing Marks External Evaluation 40 60 Minimum Passing Marks External Evaluation | Part D(Marks Distribution) Theory Minimum Passing Marks External Evaluation Min. External Evaluation 40 60 18 Practical Minimum Passing Marks External Evaluation Min. External Evaluation | Part D(Marks Distribution) Theory Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation 40 60 18 40 Practical Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation | | | |

| | Part E | | | | |
|------------------|--|--|--|--|--|
| Books | MS Swamynathan,Biotechnology in Agriculture, a Dialogue,1981 Arun K. Sharma,Hand book of organic farming Agrobios,2002 | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8751662/ | | | | |
| References Books | Arie Altman Paul Hasegawa,Plant Biotechnology and Agriculture,2011 K. Lindsey and M.G.K. Jones,Plant biotechnology in Agriculture, 1989 | | | | |
| MOOC Courses | https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128 | | | | |
| Videos | https://nptel.ac.in/courses/126105014 https://nptel.ac.in/courses/126105337 https://nptel.ac.in/courses/109106128 | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | 2 | 3 | 2 |
| CO2 | 1 | - | 2 | 3 | - | 3 | 2 | - | - | - | - | - | 1 | 2 | 2 |
| CO3 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 |
| CO4 | 2 | 1 | 2 | 2 | 1 | - | 2 | - | - | - | - | - | 2 | 2 | 1 |
| CO5 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | - | - | - | - | - | 3 | 2 | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Agricutlure Microbio | Igricutlure Microbiology | | | | | | | | |
|------------------------------------|--|--|-------|----------------|--|---|---|---|--|--|
| Course Code | DSE II (T) | ISE II (T) | | | | | | | | |
| | | Pa | art A | | | | | | | |
| Year | 3rd | Semester | 6th | Credits | | Т | P | С | | |
| Course Type | Embedded theory a | nbedded theory and lab | | | | | 0 | 3 | | |
| Course Category | Discipline Core | | | | | | | | | |
| Pre-Requisite/s | Basic knowledge of | microscope and other microbiological technique | ies | Co-Requisite/s | | | | | | |
| Course Outcomes & Bloom's Level | CO1- TO Understand and accurately apply terminology used in the field of microbiology, and understand the fundamental differences between different types of microorganisms including bacteria, viruses, fungi, prions and protozoa(BL1-Remember) CO2- Describe the structure and biology of bacterial cells, including the arrangement and replication of genetic material, and understand the concept of virulence and virulence factors(BL2-Understand) CO3- To analyse how microorganisms may be detected within various environments, including how they may be cultivated within the laboratory setting, and molecular methods of detection(BL3-Apply) CO3- To identify specific microorganisms important to animals, plants and soil ecosystems, and explain why these microorganisms are significant(BL4-Analyze) CO3- Review and evaluate readinos relating to microbiology and arricultural production(BL5-Valuate) | | | | | | | | | |
| Coures Elements | Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✓ Gender × Human Values ✓ Environment ✓ | | | | | | | | | |

| | | Part B | |
|---------|---|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Introduction – Soil as an environment for microorganisms. Classification of soil, physical and chemical properties of soil, structure of soil. Microbial interactions - mutualism, commensalism, anenasiism, synergism, parasitism, predation and competition. Microbial interactions between plants–phyllosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. Biofertilizer – VAM, Rhizobium, Frankia, Azospirillum, Azotobacter, cyanobacteria and Azolla. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments, | 8 |
| 2 | Soil microbes and fertility of soil. Roles of microbes in biogeochemical cycles, Microorganisms in soil processes, carbon cycle, organic matter decomposition, humus formation, hitrogen cycle, nitrogen fixation, symbiotic, non-symbiotic, associative organisms, ammonification, nitrification, denitrification, reactions, organisms involved. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments, | 8 |
| 3 | Plant protection – phenolics – phytoalexins and related compounds. Bio insecticides – viral, bacterial and fungal, Chemical Pesticide and their adverse effect on agriculture (soil and crop). | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments, | 8 |
| 4 | Plant pathogenic Microorganisms :- Historical Background, Disease symptoms, Mode of Entry of pathogens, Plant Disease Resistance, Physiology of Parasilism, Factors effecting disease Incidence, Algal, Fungal, Viral, Bacterial disease. Bacterial disease of agricultural crops -pathogens, symptoms and control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato. Mycoplasma Disease, Nematode Disease. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments, | 8 |
| 5 | Microorganisms Harmful to Man and Animal: - Resentence of animal to pathogens, Group of organisms causing disease, Foot mouth disease, Johne's disease, Control of Johne's disease (JD) in cattle, poisoning of livestock by blue-green algae | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, ABL Experiments, | 8 |

| | Pai | tC | | |
|---------|---|--|---------------|---------|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
| 1 | Enumeration of microbial population in soil; qualitative and quantitative distribution; | PBL | BL3-Apply | 1 month |
| 2 | isolation of symbiotic nitrogen fixing bacterianon symbiotic and associative symbiotic bacteria; | Experiments | BL3-Apply | 2 |
| 3 | soil algae ; nitrification | Experiments | BL4-Analyze | 4 |
| 4 | isolation of sulphur and iron bacteria; | Experiments | BL5-Evaluate | 2 |
| 5 | Isolation and study of phosphobacteria and phosphorus solubility | Experiments | BL5-Evaluate | 2 |

| Part D(Marks Distribution) | | | | | | |
|----------------------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|
| | Theory | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | |
| 100 | 40 | 60 | 18 | 40 | | |
| | | · | Practical | · | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | |
| 100 | 40 | 40 | 20 | 60 | | |

| Books | Martin Alexander 1976. Introduction to soil microbiology Willy Eastern Ltd. New Delhi. Robert LTate III. 1995. Soil Microbiology. John Wiley & Sons, New York, pp 398. | | | | |
|------------------|--|--|--|--|--|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8313292/ | | | | |
| References Books | Subbarao, N.S. 1977. Soil microorganisms and plant growth, Oxford & IBH Publishing Co., New Delhi. Walker, N. 1975. Soil Microbiology. Butterworths, London AGRICULTURAL MICROBIOLOGY By D. J. BAGYARAJ, G. RANGASWAMI Alexander M. 1997. Introduction to soil microbiology, John Wiley & Sons, Inc, New York. EcEldowney S., Hardman, D.J. and Waite, S. 1993. Pollution Ecology and Biotreatment-Longman Scientific Technical. | | | | |
| MOOC Courses | https://nptel.ac.in/courses/105107173 | | | | |
| Videos | https://nptel.ac.in/courses/105107173 | | | | |
| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 2 | - | - | 2 | - | - | - | 2 | 2 | - | 2 | 2 | 3 |
| CO2 | 2 | 1 | 2 | - | - | 3 | - | - | - | 2 | 1 | - | 1 | 2 | 2 |
| CO3 | 2 | 2 | 2 | - | - | 1 | - | - | - | 1 | 1 | - | 1 | 1 | 2 |
| CO4 | 1 | 2 | 1 | - | - | 2 | - | - | - | 1 | 2 | - | 3 | 1 | 1 |
| CO5 | 2 | 2 | 1 | - | - | 1 | - | - | - | 1 | - | - | 3 | 2 | 1 |
| CO6 | 2 | 2 | 3 | - | - | 3 | - | - | - | - | 2 | - | 2 | 1 | 1 |



BSc_Biotechnology

| Title of the Course | Frontiers in Biotechnol | logy & Microbiology | | | | | | | | | |
|------------------------------------|--|--|-------------|-------------------------|---|---|---|---|--|--|--|
| Course Code | DSE IV (T) | | | | | | | | | | |
| | | Part A | | | | | | | | | |
| Voar | 3rd | Somostor | 6th | Cradite | L | Т | Р | С | | | |
| Teal | 310 | Semester | our | Credits | 3 | 0 | 0 | 3 | | | |
| Course Type | Theory only | ory only | | | | | | | | | |
| Course Category | Discipline Specific Ele | iscipline Specific Elective | | | | | | | | | |
| Pre-Requisite/s | To be familiar with the | o be familiar with the basics of biomolecules, physiology and genetic composition of prokaryotic and eukaryotic cell. Co-Requisite/s | | | | | | | | | |
| Course Outcomes & Bloom's Level | Course Outcomes & Bloom's Level CO3- To understand the strategies and applications of genetically modifies crops. (BL2-Understand) CO3- To understand and apply the working principles of biofertilizers and bioinsecticides for crop improvement.(BL3-Apply) CO3- To analyze the gene behavior and genetic modifications in the field of health and medicine.(BL4-Analyze) CO4- To identify the genetic and infectious diseases using various biotechnological tools.(BL1-Remember) CO5- To develop an improved & efficient drug using homology modelling & structure-based drug designing for the treatment of various diseases(BL3-Apply) | | | | | | | | | | |
| Coures Elements | Skill Development ✓ Entrepreneurship X Employability ✓ Professsonal Ethics ✓ Gender X Human Values ✓ Environment X | , | SDG (Goals) | SDG4(Quality education) | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|--|--|-------|
| 1 | Artificial Seed – Definition, Techniques, factors affecting, applications limitations, Gemplasm preservation- Introduction, principle, Long term, storage, factors affecting, short/medium storage techniques, applications, limitations, GM Crops - Herbicide resistance, bacterial, fungal, virus, insect, Molecular farming. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| II | Biofertilizers and Biopesticide: Biofertilizers – Definition, Principle advantages. Mass production and field application – Rhizobium Azotobacter, Azospirillum, Acetobacter, Azolla, Cyanobacteria, PSB, VAM, Green manure and compost. Principle and applications of bacterial, fungal, viral and plant origin pesticides | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |
| Ш | Stem cells : unipotent, pleurepotent and totipotent stem cells, fertilization: Process, types and application, Gene therapy: Types –, Somatic, Germ line, Augmentation. Gene therapy strategies for cancer Gene therapy: Types – Somatic, Germ line, Augmentation. Gene therapy, strategies for cancer. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 9 |
| IV | Forensic medicine: Preparation of DNA sample, Approaches of DNA analysis, Public Health: Epidemiology, Diagnosis of infectious diseases, Diagnosis of genetic diseases. Diagnosis of cancer. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 9 |
| v | Structure -based drug designing: Introduction , Structure based- drug designing approaches, , Target identification and validation , Homology modelling and protein folding, pharmacophore mapping. | Tutorials, Collaborative, Demonstrations, Project methods Experiments, | 8 |

| Dort | \sim |
|------|--------|
| ган | J |

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|---|--|---------------|---------|
| 1 | Application of molecular markers in sex determination of various plants | Internships | BL5-Evaluate | 30 days |
| П | Production of Artificial seeds and its preservation | PBL | BL5-Evaluate | 6 days |

| | Part D(Marks Distribution) | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| | Theory | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | |
| | | | Practical | | · | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | |

| Books | Gupta.P.K ;Biotechnology and Genomics |
|------------------|---|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8488131/ |
| References Books | Kumar.J;Pharmaceutical Biotechnology |
| MOOC Courses | https://nptel.ac.in/courses/102103041 https://nptel.ac.in/courses/102106070 https://nptel.ac.in/courses/102103013 https://nptel.ac.in/courses/102103016 https://nptel.ac.in/courses/102103074 |
| Videos | https://nptel.ac.in/courses/102103041 https://nptel.ac.in/courses/102106070 https://nptel.ac.in/courses/102103013 https://nptel.ac.in/courses/102103016 https://nptel.ac.in/courses/102103074 |

| | | | | | | | Cours | e Articulatio | on Matrix | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-------|---------------|-----------|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 | - | - | - | - | - | - | 1 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | 2 | 2 |
| CO3 | 2 | 1 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | 3 | 2 | 3 |
| CO4 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | - | 3 | 1 | 3 |
| CO5 | 2 | - | 1 | - | 2 | 2 | 2 | - | - | - | - | - | 2 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Molecular Diagno | stics | | | | | | | | | | |
|------------------------------------|---|---------------------------------------|---------------|----------------|---|---|---|---|--|--|--|--|
| Course Code | DSE IV (T) | IV (T) | | | | | | | | | | |
| | Part A | | | | | | | | | | | |
| No T | 01 | 0 | 0# | 0 | L | т | Р | С | | | | |
| Year | 310 | Semester | otn | Credits | 3 | 0 | 0 | 3 | | | | |
| Course Type | Embedded theory | dded theory and lab | | | | | | | | | | |
| Course Category | Discipline Specifi | iscipline Specific Elective | | | | | | | | | | |
| Pre-Requisite/s | Student must be | aware of basic immulogy and immunolog | gical assays. | Co-Requisite/s | | | | | | | | |
| Course Outcomes & Bloom's Level | Course Outcomes & Bloom's Level CO1- understanding of the basic principles and clinical significance of laboratory testing in the field of molecular diagnostics.(BL1-Remember) CO2- Demonstrate an understanding of basic molecular diagnostic techniques(BL2-Understand) CO3- Demonstrate an understanding of electrophoresis in the separation of DNA fragments() CO4- Apply molecular diagnostic techniques to the identification and diagnosis of diseases(BL3-Apply) CO5- Understand the basics in quality control and quality assurance(BL2-Understand) | | | | | | | | | | | |
| Coures Elements | Coures Elements Skill Development ✓ Entrepreneurship × Employability ✓ Professsonal Ethics ✓ Gender × Human Values ✓ Environment × SDG (Goals) | | | | | | | | | | | |

| | | Part B | |
|---------|--|---|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Enzyme Immunoassays: Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes. Solid phases used in enzyme immunoassays. Homogeneous and heterogeneous enzyme immunoassays.Enzyme immunoassays after immuno blotting. | lecture method,Demonstrations, experiments, ABL, PBL , case studies | 6 |
| н | Enzyme immuno histochemical techniques: Use of polyclonal or monoclonal antibodies in enzymes immuno assays. Applications of enzyme immunoassays in diagnostic microbiology; Molecular methods in clinical microbiology: Applications of PCR, RFLP, Nuclear hybridization methods, Single nucleotide polymorphism and plasmid finger printing in clinical microbiology | lecture method,Demonstrations, experiments, ABL, PBL , case studies | 7 |
| ш | Laboratory tests in chemotherapy: Susceptibility tests: Micro-dilution and macro-dilution broth procedures. Susceptibility tests: Diffusion test procedures. Susceptibility tests: Tests for bactericidal activity. Automated procedures for antimicrobial susceptibility tests. | lecture method, Demonstrations, experiments, ABL, PBL, case studies | 8 |
| IV | Automation and rapid diagnostic approach: Automation in microbial diagnosis, rapid diagnostic approach including technical purification and standardization of antigen and specific antibodies. | lecture method,Demonstrations, experiments, ABL, PBL , case studies | 8 |
| v | Idiotypes and immunodiagnostic: Concepts and methods in idiotypes.Immunodiagnostic tests- Immuno florescence. Radioimmunoassay. Diagnostic tools: HPLC, Electron microscopy, flow cytometry and cell sorting. | lecture method,Demonstrations, experiments, ABL, PBL , case studies | 8 |

Part C

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|---|--|---------------|--------|
| I | To isolate genomic DNA from the animal sample | Experiments | BL3-Apply | 6 |
| II | To anlayse immunological activity using various assays | PBL | BL3-Apply | 7 |
| 111 | To perform ELISA test | PBL | BL5-Evaluate | 6 |
| IV | To preform radial immunodiffsion | Experiments | BL3-Apply | 5 |
| v | To analyse the AIDS patients through immunological assays and moelcular markers | Case Study | BL5-Evaluate | 1 week |
| VI | Detection and identification of microorganisms using molecular techniques | PBL | BL3-Apply | 1 week |

| Theory | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | |
| | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | |

| Part E | | | | | | | | |
|------------------|---|--|--|--|--|--|--|--|
| Books | Williams, Bethany Jill, Chloe Knowles, and Darren Treanor. "Maintaining quality diagnosis with digital pathology: a practical guide to ISO 15189 accreditation." Journal of clinical pathology 72.10 (2019): 663-668. Modern Approaches to Quality Control. Croatia, IntechOpen, 2011. | | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1214554/ | | | | | | | |
| References Books | Mountzoglou, Anastasius, ed. Laboratory Management Information Systems: Current Requirements and Future Perspectives: Current Requirements and Future Perspectives. IGI Global, 2014. Burnett, David. A Practical Guide to ISO 15189 in Laboratory Medicine. United Kingdom, ACB Venture Publications, 2013. | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/127105391 | | | | | | | |
| Videos | https://nptel.ac.in/courses/127105391 | | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 3 | 1 | 1 | - | 1 | - | - | - | - | - | - | 3 | 3 | 1 |
| CO2 | 1 | 3 | 2 | 2 | 1 | 3 | - | - | - | - | - | - | 2 | 2 | 1 |
| CO3 | 1 | 1 | 2 | - | 1 | 3 | - | - | - | - | - | - | 2 | 2 | 1 |
| CO4 | 2 | 1 | 2 | 1 | 3 | 1 | - | - | - | - | - | - | 2 | 1 | 3 |
| CO5 | 1 | 1 | - | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 1 | 1 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Medical Biotechnolog | ду | | | | | | | | | |
|------------------------------------|--|--|---|---------------------------|--|--------|--------|--------|--|--|--|
| Course Code | DSE V (T) | | | | | | | | | | |
| | | Part | Ą | | | | | | | | |
| Year | 4th | Semester | 7th | Credits | | т 0 | P 0 | C 2 | | | |
| Course Type | Embedded theory ar | mbedded theory and lab | | | | | | | | | |
| Course Category | Discipline Specific E | Jiscipline Specific Elective | | | | | | | | | |
| Pre-Requisite/s | Students acquainted its principles in mode | d with the fundamental concepts of nanotechnolog ern biotechnology applications. | Co-Requisite/s | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- The students a CO2- To understand CO3- To learn about CO4- The students w | are introduced to the biological revolutions in this the role of biotechnology in the world wide market biosensors, vaccine production, monoclonal antiti will be able to demonstrate the use of biotechnolog | ield.(BL1-Remember) t(BL2-Understand) podies, nanotechnology and its applications.(I gy in solving various medical problems(BL3- 4 | BL2-Understand) Apply) | | | | | | | |
| Coures Elements | Coures Elements Skill Development ✓ Entrepreneurship × Employability ✓ Ordessonal Ethics ✓ Gender × Human Values ✓ Environment × SDG (Goals) SDG3(Good health and well-being) SDG4(Quality education) | | | | | | | | | | |

| | Part B | | | | | | | | | | |
|---------|---|---|-------|--|--|--|--|--|--|--|--|
| Modules | Contents | Pedagogy | Hours | | | | | | | | |
| 1 | Introduction – Origin, significance & worldwide market of Medical Biotechnology. Revolution in clinical diagnosis, Antibody and Nucleic Acid Hybridization techniques, Imaging techniques (Nanodiagnosis). | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 | | | | | | | | |
| 11 | Genetic & Metabolic Disorders – Introduction, Classification, Impact of genetic diseases on human health - Chromosome errors - Down syndrome, Klinefelter's and Turner's syndrome. Metabolic disorders – Phenylketnouria, Homocystinuris, Mucopolysaccharidosis, Gangliosidosis, Gaucher's disease, Diabetes, Hemophilia and sickle cell anemia. Treatment of Genetic diseases - prenatal diagnosis, Genetic Counseling - Ethical, Legal and Social Issues | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 | | | | | | | | |
| ш | Revolution in treatment – Recombinant DNA technology for human insulin, Hepatitis B vaccine. Tissue plasminogen activator, clotting factor VIII. Antibody Engineering and Therapeutic Antibodies. Phage therapy. | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 | | | | | | | | |
| IV | Cancer - Molecular, cellular and genetic basis of cancer, tumor virus and oncogenes, tumor suppressor genes and mechanism of action of p53 proteins. Stem Cells - Sources and types of stem cells, Stem cell transplant and its types, Potential targets for stem cell treatment, Therapeutic applications of stem cells, Regenerative medicine and Stem cell ethics. Skin Grafting | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 | | | | | | | | |
| V | Gene therapy- basic approaches and types of gene therapy, vectors used in gene therapy, application of gene therapy in medicine. Nanobiotechnology - Introduction, types and structures of nanoparticles, biosynthesis of nanoparticles, application of nanoparticles in treatment. | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 | | | | | | | | |

Part C

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|--|--|---------------|-------|
| I | Biochemical test for identification of bacteria | Experiments | BL4-Analyze | 3 |
| П | Extraction and separation of Antigen proteins from Bacteria & protozoa | Experiments | BL4-Analyze | 3 |
| ш | Estimation of blood glucose. | Experiments | BL4-Analyze | 2 |
| IV | Estimation of cholesterol in blood. | Experiments | BL4-Analyze | 2 |
| v | Estimation of iron in blood. | Experiments | BL5-Evaluate | 3 |
| VI | Biological synthesis of nanoparticles | Experiments | BL6-Create | 2 |
| VII | Widal test | PBL | BL4-Analyze | 5 |

| | Part D(Marks Distribution) | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| Theory | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | |
| | | | Practical | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| | | | | | | | | | |

| Books | Glick B.R. and PasurankMolecular biotechnology – Principle and Applications of Recombinant DNA- J.I.(4th edition), ASM Press. 2010. Anthony D. Ho, Hoffman. R, and Esmail D. Zanjani, Stem Cell Transplantation (4th edition), Wiley – liss publishers, 2006. Hornyak. G.L, Moore. J.J. Tibbals H.F., Dutta. J. Fundamentals of Nanotechnology (1st edition), CRC press, 2008. |
|------------------|--|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/ |
| References Books | Jogdand. S. N. Medical Biotechnology -, (4th edition), Himalayan publishing house, 2004. Freshney.I, Stacey. G. N, Auerbach.J.M, Culture of Human Stem Cells (1st edition), Wiley – Liss publishers, 2007. |
| MOOC Courses | NA |
| Videos | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/ |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | - | 2 | 1 | 2 |
| CO3 | 3 | 1 | 1 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | 1 | 2 |
| CO4 | 2 | 1 | 1 | 2 | 1 | 3 | 1 | - | - | - | - | - | 1 | 1 | 1 |
| CO5 | 1 | 2 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Medical Biotechnolog | ау | | | | | | | | | |
|--|---|--|---|---|--|--------|--------|--------|--|--|--|
| Course Code | DSE V (T) | E V (T) | | | | | | | | | |
| | | Part / | 4 | | | | | | | | |
| Year | 4th | Semester | 7th | Credits | | т 0 | P 0 | C 3 | | | |
| Course Type | Embedded theory an | Embedded theory and lab | | | | | | | | | |
| Course Category | Discipline Specific Elective | | | | | | | | | | |
| Pre-Requisite/s | Students acquainted its principles in mode | with the fundamental concepts of nanotechnolog ern biotechnology applications. | Co-Requisite/s | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- The students a CO2- To understand CO3- To learn about CO4- The students v | are introduced to the biological revolutions in this f the role of biotechnology in the world wide marke biosensors, vaccine production, monoclonal antit vill be able to demonstrate the use of biotechnolog | ield (BL1-Remember) t(BL2-Understand) podies, nanotechnology and its applications.(I gy in solving various medical problems(BL3- 4 | BL2-Understand) Apply) | | | | | | | |
| Skill Development ✓ Entrepreneurship × Employability ✓ Employability ✓ Professional Ethics ✓ SDG (Goals) Gender × Human Values ✓ Environment × Environment × | | | | SDG3(Good health and well-being) SDG4(Quality education) | | | | | | | |

| | | Part B | |
|---------|---|---|-------|
| Modules | Contents | Pedagogy | Hours |
| I | Introduction – Origin, significance & worldwide market of Medical Biotechnology. Revolution in clinical diagnosis, Antibody and Nucleic Acid Hybridization techniques, Imaging techniques (Nanodiagnosis). | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 |
| 11 | Genetic & Metabolic Disorders – Introduction, Classification, Impact of genetic diseases on human health - Chromosome errors - Down syndrome, Klinefelter's and Turner's syndrome. Metabolic disorders – Phenylketonuria, Homocystinuris, Mucopolysaccharidosis, Gangliosidosis, Gaucher's disease, Diabetes, Hemophilia and sickle cell anemia. Treatment of Genetic diseases - prenatal diagnosis, Genetic Counseling - Ethical, Legal and Social Issues | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 |
| Ш | Revolution in treatment – Recombinant DNA technology for human insulin, Hepatitis B vaccine. Tissue plasminogen activator, clotting factor VIII. Antibody Engineering and Therapeutic Antibodies. Phage therapy. | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 |
| IV | Cancer - Molecular, cellular and genetic basis of cancer, tumor virus and oncogenes, tumor suppressor genes and mechanism of action of p53 proteins. Stem Cells - Sources and types of stem cells, Stem cell transplant and its types, Potential targets for stem cell treatment, Therapeutic applications of stem cells, Regenerative medicine and Stem cell ethics. Skin Grafting | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 |
| v | Gene therapy- basic approaches and types of gene therapy, vectors used in gene therapy, application of gene therapy in medicine. Nanobiotechnology - Introduction, types and structures of nanoparticles, biosynthesis of nanoparticles, application of nanoparticles in treatment. | Lectue methods, demonstrations, experiments, ABL, PBL, Field visits | 8 |

Part C

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|--|--|---------------|-------|
| I | Biochemical test for identification of bacteria | Experiments | BL4-Analyze | 3 |
| П | Extraction and separation of Antigen proteins from Bacteria & protozoa | Experiments | BL4-Analyze | 3 |
| ш | Estimation of blood glucose. | Experiments | BL4-Analyze | 2 |
| IV | Estimation of cholesterol in blood. | Experiments | BL4-Analyze | 2 |
| V | Estimation of iron in blood. | Experiments | BL5-Evaluate | 3 |
| VI | Biological synthesis of nanoparticles | Experiments | BL6-Create | 2 |
| VII | Widal test | PBL | BL4-Analyze | 5 |

| | Part D(Marks Distribution) | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Theory | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | |
| | | | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| | | | | | | | | | | |

| Books | Glick B.R. and PasurankMolecular biotechnology – Principle and Applications of Recombinant DNA- J.I.(4th edition), ASM Press. 2010. Anthony D. Ho, Hoffman. R, and Esmail D. Zanjani, Stem Cell Transplantation (4th edition), Wiley – liss publishers, 2006. Hornyak. G.L, Moore. J.J. Tibbals H.F., Dutta. J. Fundamentals of Nanotechnology (1st edition), CRC press, 2008. | | | | | | | |
|------------------|--|--|--|--|--|--|--|--|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/ | | | | | | | |
| References Books | Jogdand. S. N. Medical Biotechnology -, (4th edition), Himalayan publishing house, 2004. Freshney.I, Stacey. G. N, Auerbach.J.M, Culture of Human Stem Cells (1st edition) , Wiley – Liss publishers, 2007. | | | | | | | |
| MOOC Courses | NA | | | | | | | |
| Videos | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6153617/ | | | | | | | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | - | - | - | - | - | 2 | 1 | 2 |
| CO3 | 3 | 1 | 1 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | 1 | 2 |
| CO4 | 2 | 1 | 1 | 2 | 1 | 3 | 1 | - | - | - | - | - | 1 | 1 | 1 |
| CO5 | 1 | 2 | 2 | 1 | 1 | - | 1 | - | - | - | - | - | 1 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| | Title of the Course | Industrial N | Microbiology | | | | | | | | | |
|---------|--|---|---|--|--|--|---|--|-----------------------------|-------------------|--|--|
| | Course Code | DSE VI (T |) | | | | | | | | | |
| | | | | | Part A | | | | | | | |
| | Veer | 445 | Samaatar | 745 | Crea ditta | L | т | Р | С | | | |
| | Tear | 401 | Semester | 701 | Creaks | 3 | 0 | 1 | 4 | | | |
| | Course Type | Embedde | d theory and lab | <u> </u> | | | | | | | | |
| | Course Category | Discipline | scipline Core | | | | | | | | | |
| | Pre-Requisite/s | Explain the growth kin | e various fermentation sl netics of industrial microo | trategies and the organisms | Co-Requisite/s | the environmenta metabolites. the microbial produc | al and nutritional fac best conditions and ts | tors affecting the prod optimization protocol | duction of va needed for | arious various | | |
| | Course Outcomes & Bloom's Level | C01- To identify the different types of fermenters(BL1-Remember) C02- Explain the various fermentation strategies and the growth kinetics of industrial microorganisms (BL2-Understand) C03- Discuss the methods for the production of certain products (metabolites) using different microorganisms (BL2-Understand) C04- Describe the environmental and nutritional factors affecting the production of various metabolites(BL3-Apply) C05- Select the best conditions and optimization protocol needed for various microbial products(BL4-Analyze) | | | | | | | | | | |
| | Coures Elements | Skill Deve Entrepren Employab Professso Gender X Human Va Environm | lopment ✓ eurship ✓ ility ✓ mal Ethics ✓ alues ✓ ent ✓ | SDG (Goals) | SDG4(Quality education) SDG8(Decent work and economic growth) | | | | | | | |
| | | | | | Part B | | | | | | | |
| Modules | | Con | itents | | | Pedagogy | | | | Hours | | |
| 1 | Bioreactor / Fermenter – types & operation of Bioreactors, physico-chemical standards used in bioreactors, limitations of bioreactors, stages of fermentation processes, Media design for fermentation processes, Solid substrate fermentation, Fermenters (Stirred tank, bubble columns, airlif. Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid fermentation | | | | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | | | | | 8 | | |
| 2 | Technology of Microbial cell main aseptic & sterile environment (ho preservation, maintenance and s | ntenance – ow to inocul strain impro | steps to maintain microb ate, preserve & maintain vement by mutation of g | vial culture in an ı), Strain ene transfer | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits 8 | | | | | 8 | | |

| | preservation, maintenance and strain improvement by mutation of gene transfer processes. | ······································ | |
|---|--|--|---|
| 3 | Downstream processing – extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites), Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, Iactic acid, o-amylase, profease penicillin, tetracycline and vitamin B12, with reference to easily available raw materials, Production of herbal drugs. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits | 8 |
| 4 | Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 5 | Biotechnology in specific medical & industrial applications - Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textiles, painted surfaces and their prevention, Biofilms, microbial biopolymers, bio- surfactants, Microbial culture selection with high yield potential. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits | 8 |

| | Part C | | | | | | | | | | | |
|---------|--|--|----------------|----------|--|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | | |
| 1 | Study different parts of fermenter | Experiments | BL2-Understand | 2 | | | | | | | | |
| 1 | To check the antimicrobial properties of Asoca sarca | PBL | BL4-Analyze | 2 months | | | | | | | | |
| 4 | Solid state fermentation – Mushroom production | Experiments | BL3-Apply | 2 | | | | | | | | |
| 5 | Production of Wine from Grapes | Experiments | BL3-Apply | 2 | | | | | | | | |
| 6 | Cell separation of yeast and LAB by Centrifugal and Filtration | Experiments | BL3-Apply | 2 | | | | | | | | |

| Theory | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 40 | 12 | 60 | | | | | | |
| | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 40 | 20 | 60 | | | | | | |

| | Part E | | | | | | | |
|--|--|--|--|--|--|--|--|--|
| Books | L. E. Casida Industrial Microbiology (1st Edition) | | | | | | | |
| Articles | strainimprovement-130430125756-phpapp02.pdf | | | | | | | |
| References Books Nduka Okafor Modern Industrial Microbiology and Biotechnology-1st Edition | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022 | | | | | | | |
| Videos | https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022 | | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | - | 1 | 1 | 3 | 1 | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 1 | 1 | 1 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | - |
| CO3 | 3 | 2 | 3 | - | 3 | - | 1 | - | - | - | - | - | 3 | 1 | 3 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | 2 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| | Title of the Course | Industrial | Microbiology | | | | | | | |
|--|--|--------------------------|---|--|--|---|---|---|---|-------------------|
| | Course Code | DSE VI (T |) | | | | | | | |
| | | | | | Part A | | | | | |
| | Voor | Ath | Somostor | Zth | Cradita | L | т | Р | С | |
| | Tear | 401 | Semester | 701 | Credits | 3 | 0 | 1 | 4 | |
| | Course Type | Embedde | d theory and lab | | | | • | | | |
| | Course Category | Discipline | Core | | | | | | | |
| | Pre-Requisite/s | Explain th growth kir | le various fermentation st netics of industrial microo | trategies and the rganisms | Co-Requisite/s | the environmental and nutritional factors affecting the production of variou metabolites. the best conditions and optimization protocol needed for var microbial products | | | | arious various |
| | Course Outcomes & Bloom's Level CO1- To identify the different types of fermenters(BL1-Remember) CO2- Explain the various fermentation strategies and the growth kinetics of industrial microorganisms (BL2-Understand) CO3- Discuss the methods for the production of certain products (metabolites) using different microorganisms (BL2-Understand) CO4- Describe the environmental and nutritional factors affecting the production of various metabolites(BL3-Apply) CO5- Select the best conditions and optimization protocol needed for various microbial products(BL4-Analyze) | | | | | | | | | |
| Skill Development ✓ Entrepreneurship ✓ Employability ✓ Professsonal Ethics ✓ Gender × Human Values ✓ Environment ✓ | | | | SDG4(Quality education) SDG8(Decent work and economic growth) | | | | | | |
| | | | | | Part B | | | | | |
| Modules | | Cor | itents | | Pedagogy | | | | | Hours |
| 1 | Bioreactor / Fermenter – types & operation of Bioreactors, physico-chemical standards used in bioreactors, limitations of bioreactors, stages of fermentation processes, Media design for fermentation processes, Solid substrate fermentation, Fermenters (Stirred teach which enumers of editor Bioreactors). | | | | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | | | | | 8 |

| 1 | design for refinentiation processes, Solid substrate termentation, refinentiers (Sufred tank, bubble columns, airlift. Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid fermentation | Tutonais, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
|---|--|--|---|
| 2 | Technology of Microbial cell maintenance – steps to maintain microbial culture in an aseptic & sterile environment (how to inoculate, preserve & maintain), Strain preservation, maintenance and strain improvement by mutation of gene transfer processes. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits | 8 |
| 3 | Downstream processing – extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites), Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, lactic acid, ac-amylase, protease penicillin, tetracycline and vitamin B12, with reference to easily available raw materials, Production of herbal drugs. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits | 8 |
| 4 | Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes, technology of enzyme production, use of immobilized cells and enzymes (Ca-alginate beads, polyacrylamide), industrial applications of immobilized enzymes. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 5 | Biotechnology in specific medical & industrial applications - Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textlies, painted surfaces and their prevention, Biofilms, microbial biopolymers, bio- surfactants, Microbial culture selection with high yield potential. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visits | 8 |

| | Part C | | | | | | | | | | | |
|---------|--|--|----------------|----------|--|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | | |
| 1 | Study different parts of fermenter | Experiments | BL2-Understand | 2 | | | | | | | | |
| 1 | To check the antimicrobial properties of Asoca sarca | PBL | BL4-Analyze | 2 months | | | | | | | | |
| 4 | Solid state fermentation – Mushroom production | Experiments | BL3-Apply | 2 | | | | | | | | |
| 5 | Production of Wine from Grapes | Experiments | BL3-Apply | 2 | | | | | | | | |
| 6 | Cell separation of yeast and LAB by Centrifugal and Filtration | Experiments | BL3-Apply | 2 | | | | | | | | |

| Theory | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 40 | 40 | 12 | 60 | | | | | | |
| | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 40 | 20 | 60 | | | | | | |

| | Part E | | | | | | | |
|------------------|--|--|--|--|--|--|--|--|
| Books | L. E. Casida Industrial Microbiology (1st Edition) | | | | | | | |
| Articles | strainimprovement-130430125756-phpapp02.pdf | | | | | | | |
| References Books | Nduka Okafor Modern Industrial Microbiology and Biotechnology-1st Edition | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022 | | | | | | | |
| Videos | https://nptel.ac.in/courses/102106053 https://nptel.ac.in/courses/102106022 | | | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | - | 1 | 1 | 3 | 1 | - | - | - | - | - | 1 | 2 | 1 |
| CO2 | 1 | 1 | 1 | 3 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | - |
| CO3 | 3 | 2 | 3 | - | 3 | - | 1 | - | - | - | - | - | 3 | 1 | 3 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | 2 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Food and Dairy Microbiology | | | | | | | | | |
|------------------------------------|--|--|--|-------------------------|---|---|---|---|--|--|
| Course Code | DSE VII (T) | | | | | | | | | |
| - | Part A | | | | | | | | | |
| Voar | Vore die Orentee Oite Orentie | | | | | | Р | С | | |
| Tear | 401 | Semester | our | Ciedits | 3 | 0 | 1 | 4 | | |
| Course Type | Embedded theory and lab | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | |
| Pre-Requisite/s | Explain the environmen | interactions between microon t, and factors influencing their | ganisms and the food growth and survival. | Co-Requisite/s | Describe the characteristics of foodborne, waterborne, and spoilage microorganisms, and methods for their isolation, detection, and identification. | | | | | |
| Course Outcomes & Bloom's Level | CO1- Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival. (BL1-Remember) CO2- Explain the significance and activities of microorganisms in food. (BL2-Understand) CO3- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification. (BL3-Apply) CO4- Explain why microbiological quality control programmes are necessary in food production.(BL3-Apply) CO5- Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product.(BL4-Analyze) | | | | | | | | | |
| Coures Elements | Skill Develo Entreprenet Employabili Professsona Gender X Human Valu Environmen | pment ✓ urship ✓ ty ✓ al Ethics ✓ ues ✓ tt ✓ | SDG (Goals) | SDG4(Quality education) | | | | | | |

| | | Part B | |
|---------|---|---|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Introduction to microbiology: Microbiology in daily life, Characteristics and morphology of bacteria, fungl, virus, protozoa and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- PH, Water activity, O2 availability, Temperature, Pressure, and Radiation. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 2 | Principles, 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, SO2, nitrite and nitrates, ethylene oxide, antibiotics, and bacteriocins. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 3 | Contamination and spoilage of different foods: Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, Meat, fish, egg, and poultry. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit | 8 |
| 4 | Foodborne illness: Food intoxication- Staphylococcal intoxication, botulism. Food infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E. coli infection, Yersinia enterocolitica, Listeria monocytogenes, Campylobacter jejuni, and others. Pre-biotic and pro-biotic | utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit | 8 |
| 5 | SCP- Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP; Fat from microorganisms- Microorganisms used raw materials, production of fat; Production of amino acids; Production or other substances added to foods. Production of enzymes- amylases, invertase, pectolytic enzymes, proteolytic enzymes, and other enzymes | utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit | 8 |

|--|

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|--|--|----------------|-------|
| 1 | Staining of microorganisms | Experiments | BL3-Apply | 2 |
| 2 | Composition, preparation and sterilization of media | Experiments | BL3-Apply | 2 |
| 3 | Demonstration of techniques for pure culture of microorganisms | Experiments | BL4-Analyze | 2 |
| 4 | Streak plate method | Experiments | BL3-Apply | 2 |
| 5 | Pour plate method. | Experiments | BL3-Apply | 2 |
| 6 | Serial dilution agar plate method | Experiments | BL4-Analyze | 2 |
| 7 | Microbiology testing of milk | PBL | BL4-Analyze | 2 |
| 8 | Serial dilution agar plate method | Experiments | BL4-Analyze | 2 |
| 9 | To visit the various food industries in order to learn the basic methodologies | Industrial Visit | BL2-Understand | 5 |
| 10 | To visualize the effect of antibiotics on the expression and growth of fungi and Bacterial cell. | PBL | BL3-Apply | 4 |
| 11 | To determine the production of primary and secondary metabolites by Endophytic Microorganism. | PBL | BL3-Apply | 4 |

| | Part D(Marks Distribution) | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| | Theory | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 50 | 40 | 12 | 60 | | | | | |
| | | | Practical | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 50 | 40 | 20 | 60 | | | | | |

| Part E | | | | | | | |
|------------------|---|--|--|--|--|--|--|
| Books | Virendra Kumar Pande Textbook of Food Microbiology 1st Edition | | | | | | |
| Articles | https://academic.oup.com/jimb | | | | | | |
| References Books | John C. Ayres Microbiology of Foods 2nd Edition Frazier, W.C. Food Microbiology 4th edition Pelzar, H.J. and Rober, D. Microbiology 5th edition | | | | | | |
| MOOC Courses | https://onlinecourses.nptel.ac.in/noc24_ag03/preview https://onlinecourses.nptel.ac.in/noc23_ag02/preview https://nptel.ac.in/courses/126105015 https://nptel.ac.in/noc24_ag07/preview | | | | | | |
| Videos | https://nptel.ac.in/courses/102105058 | | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | 1 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 1 | 2 |
| CO2 | 2 | 2 | 1 | 3 | 1 | 3 | 2 | - | - | - | - | 2 | 1 | 2 | 1 |
| CO3 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | - | - | - | 1 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 2 | - | - | - | 1 | 2 | 3 | 1 |
| CO5 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | 3 | 1 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Food and D | Food and Dairy Microbiology | | | | | | | | | |
|------------------------------------|--|--|-------------|-------------------------|---|---|---|------------------------|--|--|--|
| Course Code | DSE VII (T) | JSE VII (T) | | | | | | | | | |
| Part A | | | | | | | | | | | |
| Voor | 4th | Somester | 9th | Cradita | L | т | Р | С | | | |
| Tear | 401 | Semester | our | Ciedits | 3 | 0 | 1 | 4 | | | |
| Course Type | Embedded | Embedded theory and lab | | | | | | | | | |
| Course Category | Discipline C | Discipline Core | | | | | | | | | |
| Pre-Requisite/s | Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival. Co-Requisite/s Describe the characteristics of foodborne, waterborne spoilage microorganisms, and methods for their isolat detection, and identification. | | | | | | | orne, and solation, | | | |
| Course Outcomes & Bloom's Level | CO1- Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival. (BL1-Remember) CO2- Explain the significance and activities of microorganisms in food. (BL2-Understand) CO3- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification. (BL3-Apply) CO4- Explain why microbiological quality control programmes are necessary in food production. (BL3-Apply) CO5- Explain the effects of formentation in food production and how it influences the microbiological quality and status of the food product. (BL4-Analyze) | | | | | | | | | | |
| Coures Elements | Skill Develo Entreprene Employabili Professson Gender X Human Valu Environmer | ppment ✓ urship ✓ ity ✓ al Ethics ✓ ues ✓ t ✓ | SDG (Goals) | SDG4(Quality education) | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|---|---|-------|
| 1 | Introduction to microbiology: Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa and algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth- PH, Water activity, O2 availability, Temperature, Pressure, and Radiation. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 2 | Principles, 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, SO2, nitrite and nitrates, ethylene oxide, antibiotics, and bacteriocins. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, | 8 |
| 3 | Contamination and spoilage of different foods: Cereals, sugar and their products, Milk and milk products, Fruits and vegetables, canned foods, Meat, fish, egg, and poultry. | Tutorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit | 8 |
| 4 | Foodborne illness: Food intoxication- Staphylococcal intoxication, botulism. Food infection- Salmonellosis, Clostridium perfringens, Bacillus cereus gastroenteritis, E. coli infection, Yersinia enterocolitica, Listeria monocytogenes, Campylobacter jejuni, and others. Pre-biotic and pro-biotic | utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit | 8 |
| 5 | SCP- Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP; Fat from microorganisms- Microorganisms used raw materials, production of fat; Production of amino acids; Production or other substances added to foods. Production of enzymes- amylases, invertase, pectolytic enzymes, proteolytic enzymes, and other enzymes | utorials, Collaborative, Demonstrations, Project methods, Hands on experience, Experiments, industrial visit | 8 |

Part C

| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
|---------|--|--|----------------|-------|
| 1 | Staining of microorganisms | Experiments | BL3-Apply | 2 |
| 2 | Composition, preparation and sterilization of media | Experiments | BL3-Apply | 2 |
| 3 | Demonstration of techniques for pure culture of microorganisms | Experiments | BL4-Analyze | 2 |
| 4 | Streak plate method | Experiments | BL3-Apply | 2 |
| 5 | Pour plate method. | Experiments | BL3-Apply | 2 |
| 6 | Serial dilution agar plate method | Experiments | BL4-Analyze | 2 |
| 7 | Microbiology testing of milk | PBL | BL4-Analyze | 2 |
| 8 | Serial dilution agar plate method | Experiments | BL4-Analyze | 2 |
| 9 | To visit the various food industries in order to learn the basic methodologies | Industrial Visit | BL2-Understand | 5 |
| 10 | To visualize the effect of antibiotics on the expression and growth of fungi and Bacterial cell. | PBL | BL3-Apply | 4 |
| 11 | To determine the production of primary and secondary metabolites by Endophytic Microorganism. | PBL | BL3-Apply | 4 |

| Part D(Marks Distribution) | | | | | | | | | |
|----------------------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| Theory | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 50 | 40 | 12 | 60 | | | | | |
| | | | Practical | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 50 | 40 | 20 | 60 | | | | | |

| Part E | | | | | | | |
|------------------|---|--|--|--|--|--|--|
| Books | Virendra Kumar Pande Textbook of Food Microbiology 1st Edition | | | | | | |
| Articles | https://academic.oup.com/jimb | | | | | | |
| References Books | John C. Ayres Microbiology of Foods 2nd Edition Frazier, W.C. Food Microbiology 4th edition Pelzar, H.J. and Rober, D. Microbiology 5th edition | | | | | | |
| MOOC Courses | https://onlinecourses.nptel.ac.in/noc24_ag03/preview https://onlinecourses.nptel.ac.in/noc23_ag02/preview https://nptel.ac.in/courses/126105015 https://nptel.ac.in/noc24_ag07/preview | | | | | | |
| Videos | https://nptel.ac.in/courses/102105058 | | | | | | |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 1 | 2 | 1 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 1 | 2 |
| CO2 | 2 | 2 | 1 | 3 | 1 | 3 | 2 | - | - | - | - | 2 | 1 | 2 | 1 |
| CO3 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | - | - | - | 1 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 2 | - | - | - | 1 | 2 | 3 | 1 |
| CO5 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | 3 | 1 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_Biotechnology

| Title of the Course | Pharmaceutical Biot | rmaceutical Biotechnology | | | | | | | | | |
|------------------------------------|--|---|--|--|---|---|---|---|--|--|--|
| Course Code | DSE VII (T) | | | | | | | | | | |
| Part A | | | | | | | | | | | |
| Veer | 445 | Someotor | 016 | Credite | L | Т | Ρ | С | | | |
| Tear | 401 | Semester | oui | Creats | 2 | 0 | 0 | 2 | | | |
| Course Type | Embedded theory a | pedded theory and lab | | | | | | | | | |
| Course Category | Disciplinary Major | ciplinary Major | | | | | | | | | |
| Pre-Requisite/s | Student must know of microorganisms i | tudent must know Genetic engineering applications in relation to production of pharmaceuticals and the use f microorganisms in fermentation technology Co-Requisi | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To remember CO2- Understandin CO3- To apply Gen CO4- To understand CO5- To apply and | the basic concpet of enzymes, drug, gene and g the importance of Immobilized enzymes in Ph- etic engineering applications in relation to produ d the Importance of Monoclonal antibodies in Inc anlayze the Appreciate the use of microorganisr | genome interaction (BL1-Remember) armaceutical Industries(BL2-Understand) ction of pharmaceuticals(BL3-Apply) lustries(BL2-Understand) ns in fermentation technology(BL4-Analyze | 9) | | | | | | | |
| Coures Elements | Skill Development ✓ Entrepreneurship X Employability ✓ Professsonal Ethics Gender X Human Values ✓ Environment ✓ | / : : | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) | | | | | | | |

Part B

| Modules | Contents | Pedagogy | Hours |
|---------|---|--|-------|
| 1 | Brief introduction to Biotechnology with reference to Pharmaceutical Sciences,Enzyme Biotechnology- Methods of enzyme immobilization and applications,Biosensors-Working and applications of biosensors in Pharmaceutical Industries, Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 7 |
| 11 | Basic principles of genetic engineering,cloning vectors, restriction endonucleases and DNA ligase, Recombinant DNA technology. Application of genetic engineering in medicine,production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 8 |
| ш | Types of immunity- humoral immunity, cellular immunity, General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity, Storage conditions and stability of official vaccines | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 8 |
| IV | ,Hybridoma technology- Production, Purification and Applications, Immuno blotting techniques- ELISA, Western blotting, Southern blotting,Introduction to Microbial biotransformation and applications. | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 8 |
| v | Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.,Large scale production fermenter design and its various controls,Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 7 |

| | Part C | | | | | | | | | | | |
|---------|---|--|----------------|---------|--|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | | |
| I | Isolation of enzymes from natural isolates | PBL | BL3-Apply | 1 week | | | | | | | | |
| П | production of immobilized enzymes using isolated enzymes | PBL | BL6-Create | 7 | | | | | | | | |
| ш | Isolation of genomic DNA | Experiments | BL3-Apply | 6 | | | | | | | | |
| IV | To perform restriction digestion using kit and its visualization using agarose gel electrophoresis | Experiments | BL4-Analyze | 7 | | | | | | | | |
| V | Preparation of culture media and necessary arrangements for production of amino acids | Field work | BL6-Create | 30 days | | | | | | | | |
| VI | To demonstarte the working of PCR | Industrial Visit | BL2-Understand | 5 | | | | | | | | |
| VII | Preparation of different methods of medicinal plant extracts | Experiments | BL3-Apply | 3 | | | | | | | | |
| VIII | Antibacterial activity. | Experiments | BL4-Analyze | 3 | | | | | | | | |
| IX | Antifungal activity. | Experiments | BL4-Analyze | 3 | | | | | | | | |
| x | Total antioxidant activity. | PBL | BL4-Analyze | 5 | | | | | | | | |
| XI | Phytochemical screening of Primary metabolites. | PBL | BL4-Analyze | 6 | | | | | | | | |
| XII | Phytochemical screening of Secondary metabolites | PBL | BL5-Evaluate | 7 | | | | | | | | |
| XIII | Separation of medicinal plant extracts by chromatography. | PBL | BL4-Analyze | 10 | | | | | | | | |
| XIV | Estimation of ascorbic acid in multivitamin formulations | PBL | BL5-Evaluate | 5 | | | | | | | | |

| Part D(Marks Distribution) | | | | | | | | | |
|-----------------------------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| Theory | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 40 | | 60 | 18 | 40 | | | | | |
| | | | Practical | | | | | | |
| Total Marks Minimum Passing Marks | | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| | | | | | | | | | |

| Part E | | | | | | | |
|------------------|---|--|--|--|--|--|--|
| Books | J.W. Goding: Monoclonal Antibodies | | | | | | |
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525971/ | | | | | | |
| References Books | B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C. RA Goldshy et. al., : Kuby Immunology J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/102105342 | | | | | | |
| Videos | https://nptel.ac.in/courses/102105342 | | | | | | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | 1 | 1 | 2 |
| CO2 | 2 | 2 | 1 | 1 | 2 | - | 1 | - | - | - | - | - | 2 | 2 | 3 |
| CO3 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | - | 2 | 3 | 1 |
| CO4 | 3 | 1 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 3 | 3 | 1 |
| CO5 | 1 | 1 | 3 | 1 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Pharmaceutical Bio | technology | | | | | | | | | |
|------------------------------------|---|---|-------------|--|---|---|---|---|--|--|--|
| Course Code | DSE VII (T) | | | | | | | | | | |
| | Part A | | | | | | | | | | |
| Veer | 445 | Someotor | 046 | Credite | L | Т | Р | С | | | |
| Tear | 401 | Semester | oui | Creats | 2 | 0 | 0 | 2 | | | |
| Course Type | Embedded theory a | pedded theory and lab | | | | | | | | | |
| Course Category | Disciplinary Major | sciplinary Major | | | | | | | | | |
| Pre-Requisite/s | Student must know use of microorganis | Student must know Genetic engineering applications in relation to production of pharmaceuticals and the use of microorganisms in fermentation technology Co-Requisite/s | | | | | | | | | |
| Course Outcomes & Bloom's Level | Course Outcomes CO1- To remember the basic concept of enzymes, drug, gene and genome interaction (BL1-Remember) C02- Understanding the importance of Immobilized enzymes in Pharmaceutical Industries(BL2-Understand) C03- To apply Genetic engineering applications in relation to production of pharmaceuticals(BL3-Apply) C04- To understand the Importance of Monoclonal antibodies in Industries(BL2-Understand) C05- To apply and anlaze the Appreciate the use of microorganisms in fermentation technology(BL4-Analyze) | | | | | | | | | | |
| Coures Elements | Skill Development √ Entrepreneurship × Employability √ Professsonal Ethics Gender × Human Values √ Environment √ | √ < \$ √ | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) SDG8(Decent work and economic growth) SDG9(Industry Innovation and Infrastructure) | | | | | | | |

Part B

| Modules | Contents | Pedagogy | Hours |
|---------|---|--|-------|
| 1 | Brief introduction to Biotechnology with reference to Pharmaceutical Sciences,Enzyme Biotechnology- Methods of enzyme immobilization and applications,Biosensors-Working and applications of biosensors in Pharmaceutical Industries, Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 7 |
| 11 | Basic principles of genetic engineering,cloning vectors, restriction endonucleases and DNA ligase,Recombinant DNA technology. Application of genetic engineering in medicine,production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 8 |
| ш | Types of immunity- humoral immunity, cellular immunity,General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity,Storage conditions and stability of official vaccines | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 8 |
| IV | ,Hybridoma technology- Production, Purification and Applications, Immuno blotting techniques- ELISA, Western blotting, Southern blotting,Introduction to Microbial biotransformation and applications. | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 8 |
| v | Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.,Large scale production fermenter design and its various controls,Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties | Lecture method, demonstrations, experiments, field visit, ABL, PBL | 7 |

| | Pa | rt C | | |
|---------|---|--|----------------|---------|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours |
| I | Isolation of enzymes from natural isolates | PBL | BL3-Apply | 1 week |
| 11 | production of immobilized enzymes using isolated enzymes | PBL | BL6-Create | 7 |
| Ш | Isolation of genomic DNA | Experiments | BL3-Apply | 6 |
| IV | To perform restriction digestion using kit and its visualization using agarose gel electrophoresis | Experiments | BL4-Analyze | 7 |
| V | Preparation of culture media and necessary arrangements for production of amino acids | Field work | BL6-Create | 30 days |
| VI | To demonstarte the working of PCR | Industrial Visit | BL2-Understand | 5 |

| Part D(Marks Distribution) | | | | | | | |
|----------------------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|
| | Theory | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| 100 | 40 | 60 | 18 | 40 | | | |
| | | · | Practical | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| | | | | | | | |

| Books | J.W. Goding: Monoclonal Antibodies |
|------------------|---|
| Articles | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525971/ |
| References Books | B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C. RA Goldshy et. al., : Kuby Immunology J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal |
| MOOC Courses | https://nptel.ac.in/courses/102105342 |
| Videos | https://nptel.ac.in/courses/102105342 |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | 1 | 1 | 2 |
| CO2 | 2 | 2 | 1 | 1 | 2 | - | 1 | - | - | - | - | - | 2 | 2 | 3 |
| CO3 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | - | 2 | 3 | 1 |
| CO4 | 3 | 1 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 3 | 3 | 1 |
| CO5 | 1 | 1 | 3 | 1 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_FoodTechnology

| Title of the Course | Food Additives [T] | | | | | | | | | |
|------------------------------------|--|-------------------------------|-------------|---|-------|---|---|---|--|--|
| Course Code | FT-103[T] | | | | | | | | | |
| | - | | Part A | | | | | | | |
| Veer | 1.01 | т | Р | С | | | | | | |
| Tear | ISL | Semester | ISL | Creats | 4 | 0 | 0 | 4 | | |
| Course Type | Theory only | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | |
| Pre-Requisite/s | BSc degree in Food Technology, Food Science, Food Engineering, Food Chemistry, Biotechnology, Microbiology, Biochemistry, or any other related field with a minimum of 50% marks. | | | | | | Students must have basic knowledge of preservatives, chemical compounds and adultrants. | | | |
| Course Outcomes & Bloom's Level | C01- The students will be able to comprehend about importance, classification and functions of additives like preservatives, acid, base, salts, chelating/sequestering agents, non- nutritive sweetness, emulsifier, stabilizer, thickeners, antioxidants, anticaking agents, firming agents, flour bleaching agents, bread improves and antimicrobial agents, humectants, acidulates, leavening agents in maintaining or improving food quality, BL1-Remember) C02- To give insight to various terminology such as isolation, functional properties and applications of proteins, starches and lipids as functional ingredients. (BL2-Understand) C03- The students will be able to demonstrate the types and stability of flavours during food processing. They will also know about flavor emulsions, essential oils and oleoresins. (BL3-Apply) C04- The course will dilustrate the types and recommended doses of coloring agents. (BL4-Analyze) C05- The course will describe the e-codes and uses and function of food additives in diffuent food formulations, (BL5-Evaluate) | | | | | | | | | |
| Coures Elements | Skill Developm Entrepreneursh Employability ✓ Professsonal E Gender X Human Values Environment ✓ | ent X ip ✓ thics ✓ X | SDG (Goals) | SDG3(Good health and well-being) SDG12(Responsible consuption and produc | tion) | | | | | |

| | | Part B | |
|---------|--|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Introduction of food additives, classification and functions, preservatives, acid, base, salts, chelating/sequestering agents, nonnutritive sweetness, antioxidants, anticaking agents, firming agents, bulking agents, flour bleaching agents, bread improves and antimicrobialagents, humectants, acidulates, leavening agents. | Audio/Video clips, group discussion, lecture with ppt, quiz | 12 |
| 2 | Protein, starches and lipids as functional ingredients, isolation, functional properties and application in different food (modified starch), manufacturing and applications of fibers from food sources. | Audio/Video clips, group discussion, lecture with ppt, Review Analysis | 12 |
| 3 | Flavor technology-types of flavor, stability of flavors during food processing extraction and analysis techniques of flavor, flavor emulsions, essential oils andoleoresin. | Audio/Video clips, group discussion, lecture with ppt, classroom presentations | 12 |
| 4 | Coloring agents. Types, recommended doses of color. Sweeteners: Introduction, types, properties and uses of saccharin, acesulfame-K, aspartame, HFCS, invert sugar, and sugar alcohols (polyols) as sweeteners in food products | Audio/Video clips, group discussion, lecture with ppt, quiz | 10 |
| 5 | Emulsifiers: Introduction, types, selection of emulsifiers, emulsion stability, and mechanism of action. Thickeners and hydrocolloids: Introduction and types E-codes, CAS system. Uses and function of food additives in food formulations (different products). | Audio/Video clips, group discussion, lecture with ppt, quiz | 09 |

Part D(Marks Distribution)

| | Theory | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| 100 | 40 | 60 | 18 | 40 | 0 | | |
| | Practical | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | |
| | | | | | | | |

Part E

| Books | |
|------------------|--|
| Articles | |
| References Books | Food Additives by BranenAL,DavidsonPMandSalminen S Encyclopedia of Food and Color Additives by Gerorge AB Fenaroli's Handbook of Flavor Ingredients by Gerorge AB Food Flavors by Morton IDandMacleod AJ Food Proteins by NakaiS andModlerHW |
| MOOC Courses | https://nptel.ac.in/courses/126105027 |
| Videos | https://youtu.be/Dm3yP7FF4nl |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO2 | 3 | 1 | 1 | 2 | 2 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO3 | 3 | 1 | 1 | 3 | 2 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO4 | 3 | 2 | 1 | 1 | 2 | 2 | - | - | - | - | - | 2 | 3 | 3 | 3 |
| CO5 | 3 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | 2 | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_FoodTechnology

| Title of the Course | Food Safety and | Food Safety and Management [T] | | | | | | | | |
|------------------------------------|--|---|--|---|-------|---|---|--------------------------------------|--|--|
| Course Code | FT-303 [T] | | | | | | | | | |
| | Part A | | | | | | | | | |
| Yeer | | | | | | т | Р | С | | |
| Tear | 2110 | Semester | 310 | Credits | 4 | 0 | 0 | 4 | | |
| Course Type | Theory only | | | | | | | | | |
| Course Category | Discipline Core | | | | | | | | | |
| Pre-Requisite/s | Student must ho Chemistry or equision should be 50% | ld a B.Sc degree in Food Technolog uivalent. The minimum percentage in | y, B.Sc. Biology, B.Sc. Bio- the qualifying examination | Co-Requisite/s Students should have prior knowledge of food hazards, risk, food safety and Critical control points. | | | | | | |
| Course Outcomes & Bloom's Level | C01- To comprehend the fundamentals of nutraceuticals, nutrigenomics and functional foods. They will also learn the applications of rheology and texture profile analysis in pro- development. (BL1-Remember) C02- To describe, basics of product development, different steps of product development process and innovation strategies are covered which will enhance the capability of student's thinking while developing a new food product. (BL2-Understand) C03- To evaluate different aspects of food quality, total quality control and management, statistical quality control methods, which will help him to learn the development and maintenance quality of new product. (BL3-Apply) C04- To explore basics of food safety laws and regulations governing the country and the world (BL4-Analyze) C05- Illustrate technology to development new food products (product qualities, raw material properties, processing, packaging requirement, distribution and marketing). (BL5 Evaluate) | | | | | | | ; in product y of ınd (BL5- | | |
| Coures Elements | Coures Elements Skill Development × Entrepreneurship × Employability × Professsonal Ethics ✓ Gender × Human Values ✓ Environment ✓ | | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) SDG12(Responsible consuption and produc | tion) | | | | | |

| | | Part B | |
|---------|---|---|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Introduction to nutraceuticals, Nutrigenomics and Functional foods, Introduction and applications of rheology, texture profile. | Lecture methods, Audio/Video clips, group discussion, quiz | 8 |
| 2 | Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme. | Lecture methods, Audio/Video clips, group discussion, Review Analysis | 10 |
| 3 | Ways of describing of Food Quality, Quality control and Quality Assurance functions. Total Quality Control (TQC) and the role of management/ TQM. Statistical quality control. Quality costs | Lecture methods, Audio/Video clips, group discussion, classroom presentations | 9 |
| 4 | Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer, company, In-process and finished product specifications. Relevant Food laws: PFA, FPO, SWMA, MPO, AgMark, and BIS Standards. | Lecture methods, Audio/Video clips, group discussion, quiz | 12 |
| 5 | The knowledge base for product development technology – knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological knowledge (product qualities, raw material properties, processing, packaging requirement, distribution and marketing. | Lecture methods, Audio/Video clips, group discussion, quiz | 10 |

Part D(Marks Distribution)

| | Тнеогу | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | |
| 100 | 40 | 60 | 18 | 40 | | | | |
| | Practical | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | |
| | | | | | | | | |

Part E

| Books | |
|------------------|--|
| Articles | https://www.sciencedirect.com/science/article/abs/pii/S2214799316300777 |
| References Books | New Product and Process Development by Clarke and Wright Angi-angiogenic Functional and Medicinal Foods by Losso IN Handbook of Nutraceuticals and Functional Foods by Robert EC Rheology and Texture in Food Quality by J.M.DeMan Food Product Development by Earle R, Earle R and Anderson |
| MOOC Courses | https://onlinecourses.swayam2.ac.in/cec20_ag06/preview |
| Videos | https://www.youtube.com/watch?v=DSKre3Lkklg |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | 1 | 1 | - | 1 | - | - | - | - | 1 | 3 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | - | - | - | - | - | 3 | 1 | 1 |
| CO3 | 2 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO4 | 2 | 1 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO5 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | - | - | - | - | 3 | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_FoodTechnology

| Title of the Course | Research Methor | dology [T] | | | | | | | | | | |
|------------------------------------|--|--|---|---|---|--|---|---|--|--|--|--|
| Course Code | FT-305 [T] | | | | | | | | | | | |
| | | | Part A | | | | | | | | | |
| Voar | 2nd | Samastar | 3rd | Credite | L | т | Р | С | | | | |
| Tear | 2110 | Semester | 510 | Credits | 4 | 0 | 0 | 4 | | | | |
| Course Type | Soft skill | ft skill | | | | | | | | | | |
| Course Category | Specialization El | ecialization Elective Courses | | | | | | | | | | |
| Pre-Requisite/s | The student must Chemistry or equishould be 50% | t hold a B.Sc degree in Food Techno uvalent. The minimum percentage in | ology, B.Sc. Biology, B.Sc. Bio- the qualifying examination | Co-Requisite/s | Student should have basic knowledge of mean, median mode,sampling methods and probability | | | | | | | |
| Course Outcomes & Bloom's Level | C01- The course C02- The subject with its application C03- The course verification.(BL3 C04- The course C05- To apply the | e prepares the student to understand ct Research Methodology is designe ons in other fields (BL2-Understand e aims to provide experimental basis -Apply) e aims to provide basis of analyzing ne understanding of statistical tools in | I the basic concepts of Research of for post graduate students of Bic and to enable students to acquir the applications of Research Meth evaluation in various samples.(B | lethodology, its applications in experimental d technology for describing the basic concepts ea specialized knowledge and understanding odology in various fields of research and indu L5-Evaluate) | esign and fu of each and of data and stries. (BL4 - | uture prospe every divisi its applicatio Analyze) | cts. (BL1-Re on of the sub ons in experi | member) nject along mental | | | | |
| Coures Elements | CO5- Io apply the understanding of statistical tools in Skill Development ✓ Entrepreneurship × Employability × Professsonal Ethics ✓ Gender × Human Values ✓ Environment × | | SDG (Goals) | SDG4(Quality education) | | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|--|---|-------|
| 1 | Definition of Research, QualitiesofResearcher, Componentsof ResearchProblem, VariousStepsinScientific Research, TypesofResearch;HypothesesResearch Purposes -Research Design -Survey Research -Case Study Research, Research Reports, Introduction to SPSS. Technology transfer: Introduction and procedure. | Lecture methods,Audio/Video clips,group discussion,quiz | 12 |
| 2 | Data Collection: Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire Sampling Merits and Demerits-Experiments-Kinds-Procedure; Control Observation. | Lecture methods,Audio/Video-clips | 9 |
| 3 | Introduction to Statistics Probability Theories Conditional Probability, Point and Interval Estimates of Means and Proportions; Hypothesis Tests, One Sample Test-Two Sample Tests/Chi- Square Test,t-test-Standard deviation. | Lecture methods, Audio/Video-clips,group discussion | 10 |
| 4 | Statistical Applications: Analysis of Variance, Completely Randomized Design, Randomized Complete Block Design, Latin Square Design. Use of computers for preparing and presenting Documents. Standard operating procedure (S.O.P): Introduction and procedure | Lecture methods,Audio/Video-clips,group discussion,quiz | 12 |
| 5 | Research proposal and thesis writing: Purpose of research proposal, Academic/ Project/ Case study proposals, Steps for the preparing proposal and Common mistakes, Methods selecting relevant literature, Structure of Thesis, Steps in thesis writing, Citation and Referencing: Different ways of work citation, Publication in Research journals | Lecture methods,Audio/Video-clips,group discussion,quiz | 12 |

| | Part D(Marks Distribution) | | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | | | |
| | | · | Practical | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | |
| | 0 | | | | | | | | | | | | |

| Books | Kothari, C. R. (2004, January 1). Research Methodology. New Age International. |
|------------------|---|
| Articles | |
| References Books | Panneerselvam, R. (2014, April 4). RESEARCH METHODOLOGY. PHI Learning Pvt. Ltd. Wilkinson, T. S., & Bhandarkar, P. L. (2003, January 1). Methodology and Techniques of Social Research. Young, P. V. (1956, January 1). Scientific Social Surveys and Research. Englewood Cliffs, N.J. : Prentice-Hall. |
| MOOC Courses | https://nptel.ac.in/courses/110105091 |
| Videos | https://youtu.be/oXnjR00tfBI |

| | Course Articulation Matrix | | | | | | | | | | | | | | |
|-----|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 1 | 2 | 2 | - | - | - | - | - | 1 | 3 | 1 | 1 |
| CO2 | 2 | 2 | 3 | 2 | 1 | 1 | - | - | - | 1 | - | - | 3 | 1 | 1 |
| CO3 | 2 | 2 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | 3 | 1 | 1 |
| CO4 | 1 | 1 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | 3 | 3 | 3 |
| CO5 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | - | - | - | 1 | - | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



MSc_FoodTechnology

| Title of the Course | Research | n Project [P] | | | | | | | | | | |
|------------------------------------|---|--|---|---|--|------------------------------|--------|----|--|--|--|--|
| Course Code | FT-401 [F | 2] | | | | | | | | | | |
| | | | | Part A | | | | | | | | |
| Voor | and | Somester | 4+6 | Cradita | L | т | Р | С | | | | |
| Tear | 2nd Semester | | 401 | Credits | 0 | 0 | 18 | 18 | | | | |
| Course Type | Project | Project | | | | | | | | | | |
| Course Category | Projects and Internship | | | | | | | | | | | |
| Pre-Requisite/s | The student should have knowledge of food science | | | Co-Requisite/s | enable students observe, first hand, work flow and processes in food industries and associated enterprises | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- Th CO2- Th | e student will be able e student will be exp | e to appreciate diff losed to the divers | erent processing and production technologies e setting in food industries (BL5-Evaluate) | in various industri | al settings (BL4-An a | alyze) | | | | | |
| Coures Elements | Skill Dev Entrepre Employa Professs Gender 3 Human V Environn | elopment ✓ neurship X bility ✓ onal Ethics ✓ X /alues X nent X | SDG (Goals) | SDG1(No poverty) SDG2(Zero hunger) SDG3(Good health and well-being) | erty) Inger) ealth and well-being) | | | | | | | |

| | | Part B | | | | | | |
|---------|--|--|---|--|--|--|--|--|
| Modules | Contents | Pedagogy | | | | | | |
| 1 | Selection of industry relevant to food and allied products | Hands-on working experience in the industry/ Internship Report | 8 | | | | | |
| 2 | Working in department/s within the selected industry | Hands-on working experience in the industry/ Internship Report | 8 | | | | | |
| 3 | Periodic analysis of data and preparation of report | Hands-on working experience in the industry/ Internship Report | 8 | | | | | |
| 4 | Final preparation of internship report | Hands-on working experience in the industry/ Internship Report | 8 | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | | |
| | 0 | | | | | | | | | | | | | |
| | | | Practical | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | | |
| 200 | 0 | 200 | 0 | 0 | 0 | | | | | | | | | |

Part E

| Books | |
|------------------|--|
| Articles | |
| References Books | |
| MOOC Courses | |
| Videos | |

| | | | | | 1 | | | | | | | r | | | r |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 2 | 2 |
| CO2 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 2 | 3 |
| CO3 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO4 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO5 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 |



BSc_FoodTechnology

| Title of the Course | Food and Busir | ness Management | | | | | | | | | |
|------------------------------------|---|---|--|---|--|---|--|----|--|--|--|
| Course Code | GE-III | | | | | | | | | | |
| | | | Part A | | | | | | | | |
| Veer | Ond | Samaatar | 2-4 | Credite | L | т | Р | С | | | |
| Tear | 2110 | Semester | 310 | Credits | 4 | 0 | 0 | 4 | | | |
| Course Type | Theory only | Theory only | | | | | | | | | |
| Course Category | Generic Elective | | | | | | | | | | |
| Pre-Requisite/s | candidates must have studied food processing & preservation and food additives in previous semester Knowledge of food processing sector, food industry layout and food preservation | | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- To remer CO2- To under CO3- To provid CO4- To apply CO5- To evalua | nber the managerial roles, mana stand the fundamentals of mark le the students a specialized kno the subject knowledge in future ate the theoretical knowledge ar | agement processes and types eting, its research, consumer I owledge and understanding at perspectives i.e. such as fulfill d implement the same to incre | of organizations in the food businesses. (BL1 behaviour and advertising to apply them to pro- bout manpower management, government sch ing corporate social responsibility and to form base the profit of food business.(BL5-Evaluate | -Remember) omote the bus nemes, and bus ulate new bus e) | ness.(BL2-Un siness ethics. iness proposa | derstand) (BL3-Apply) Is.(BL4-Analyz | e) | | | |
| Coures Elements | Skill Developm Entrepreneurst Employability v Professsonal E Gender X Human Values Environment X | ent X hip ✓ ′ thics ✓ X | SDG (Goals) | SDG1(No poverty) SDG2(Zero hunger) SDG12(Responsible consuption and produc | tion) | | | | | | |

Part B Modules Contents Pedagogy Hours Introduction to Food Business Management- Definitions, importance and principles; Theories and functions of management; Organizational structures, principles and types 7 1 Lecture, discussion, ppt Food Products Marketing - Concept of market structure, micro and macro environments; Marketing research and marketing information systems. Consumer behaviour; consumerism; classification of food products and factors affecting prices, product life cycle; Advertising-functions, objectives, personal selling, sales promotion, publicity and public relations, product promotion strategies 2 Lecture, discussion, ppt 10 Human resource management: Definitions, objectives of manpower planning, process, sources of recruitment, process of selection; types of promotions and transfers; wage and salary administration and employee welfare; Corporate social responsibility: Importance, business ethics 3 Quiz, lecture, discussion 9 Finance management: Definition, scope, and objective; Different systems of accounting; Cost: Short run and long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost in food industry and break even analysis; Budgeting and profit planning -types of budget and their preparations 4 Audio/Video clips, group discussion, lecture with ppt, quiz 10 Government regulations/ guidelines for food business, Foreign investment policies – FDI in food processing, Preparation of Business Proposals, Case studies on project formulation in various types of food industries - their production, marketing and cost analysis 5 Audio/Video clips, group discussion, lecture with ppt, quiz 9

| | Part D(Marks Distribution) | | | | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|
| Theory | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | 0 | | | | | | | |
| | | | Practical | • | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| | 0 | | | | | | | | | | | |

| | Part E | | | | | | | | | |
|------------------|---|--|--|--|--|--|--|--|--|--|
| Books | Food and Beverage Management by Bernard Davis, Andrew Lockwood, Peter Alcott, Ioannis and S. Pantelidis | | | | | | | | | |
| Articles | | | | | | | | | | |
| References Books | Principles of Management by Gupta Meenakshi Managing by Mintzberg, H. Financial Management: Theory and Practice by Eugene F. Brigham and, Michael C. Ehrhardt | | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/110101167 | | | | | | | | | |
| Videos | https://youtu.be/YUVybfnKA9I | | | | | | | | | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | - | 2 | 3 | 3 | 3 |
| CO2 | 2 | 1 | 1 | 1 | 1 | - | - | 3 | - | 2 | - | 3 | 3 | 3 | 3 |
| CO3 | 2 | 1 | 1 | 1 | 1 | - | - | 3 | - | 2 | - | 3 | 3 | 3 | 3 |
| CO4 | 2 | 1 | 1 | 1 | 1 | - | - | 2 | - | 2 | - | 3 | 3 | 3 | 3 |
| CO5 | 2 | 1 | 1 | 1 | 1 | - | - | 2 | - | 2 | - | 3 | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Entrepreneur | ntrepreneurship Development [T] | | | | | | | | | | | |
|------------------------------------|--|---|------------------|--|--|---|---|---|--|--|--|--|--|
| Course Code | GE-IV [T] | ε-IV [Τ] | | | | | | | | | | | |
| | Part A | | | | | | | | | | | | |
| Year | 2nd | Somester | 4th | Credits | L | т | Р | С | | | | | |
| roui | 2110 | Semester | | orcano | 4 | 0 | 0 | 4 | | | | | |
| Course Type | Theory only | heory only | | | | | | | | | | | |
| Course Category | Generic Elec | ieneric Elective | | | | | | | | | | | |
| Pre-Requisite/s | Students mu previous sem | st have studied food busine: nester | ss managemnet in | Co-Requisite/s | Students should have prior knowledge of economics and basics of management | | | | | | | | |
| Course Outcomes & Bloom's Level | C01- Communicate with required clarity ensuring that the information communicated is clear and accurate. (BL1-Remember) C02- Comprehend and apply basic computer working, basic operating system and uses internet services to get accustomed & amp; take benefit of IT developments in the industry. (BL2-Understand) C03- To demonstrate knowledge of entrepreneurship and identify establishment for supporting the development of businesses/entrepreneurship.(BL3-Apply) C04- To illustrate procedures to achieve a safe working environment in line with occupational health, safety, environment regulations.(BL4-Analyze) C05- Comply time management technique in day-to-day work.(BL5-Evaluate) | | | | | | | | | | | | |
| Coures Elements | Skill Develop Entrepreneur Employability Professsonal Gender X Human Value Environment | ment × rship ✓ / ✓ Ethics ✓ es × × | SDG (Goals) | SDG1(No poverty) SDG3(Good health and well-being) | | | | | | | | | |

Part B

| Modules | Contents | Pedagogy | Hours |
|---------|---|---|-------|
| 1 | Concept and definition of Entrepreneurship; The conceptual model of Entrepreneurship given by John Kao. Views given by Schumpeter Walker & Drucker on Entrepreneurship - Entrepreneur and Manager - Enterprise and Entrepreneur. Managing Creativity Issues to be addressed in working the definition of creativity –Definition -Attributes of a creative person - Creative Thinking and Motivation - Managing Creativity - Organizational Actions that enhance and hinder Creativity -Organizational priorities and Creativity -Managerial responsibilities in a creative organization | Lecture method, quiz, group discussion | 10 |
| 2 | Definition of Small Business - Composition of Small Business- Economic Contribution of Small Business. Strategic Planning for Small Business - Steps in Strategic Planning. Forms of Ownership: Sole Proprietorship, Partnership& Corporation form of Organization Advantages and Disadvantages. Franchising- What is Franchising - Advantages and Disadvantages to Franchising - Franchise Evaluation Checklist – Franchise contracts - Types of Franchise argements. Brief insight of Startup, Entrepreneurship, features, related scheme and benefits. | Lecture method, Quiz, Illustrate with analogies | 10 |
| 3 | Introduction: Project - definition, features, types infrastructure creation-a special type of projects. The advantages and disadvantages of starting your business. The advantages and disadvantages of buying all existing business – Critical areas to be examined while buying all existing business Project Appraisal: technical appraisal, marketing appraisal, legal and environment appraisal, financial appraisal- cost estimation of the project and evaluating project using pay back and NPV, Detailed project report. Introduction to SCBA (Social cost benefit analysis). | Lecture Method, Expert Lecture, audio-video clips | 12 |
| 4 | Arrangement of funds: Traditional sources of financing – Equity shares, preference shares, Debentures/bonds, loan from financial institutions- Loan syndication and consortium finance; Alternative sources of financing- Foreign Issue, FDI & FII. SWOT analysis and its usefulness | Audio/Video clips, group discussion, lecture with ppt, quiz | 8 |
| 5 | Government schemes and incentives for promotion of entrepreneurship development Government policy for entrepreneurship development-Prime Minister's Employment Generation Program (PMEGP), Market Development Assistance Scheme for Micro/ Small Manufacturing Enterprises/Small & Micro Exporters, Rajiv Gandhi Udyami Mitra Yojana - A Scheme of "Promotion and Handholding of Micro and Small Enterprises", Schemes for Women Entrepreneurs a) Mahila Udyami Yojana (MUY) b) SBI Stree Sakthi Package c) Priya Darshini Yojana | Audio/Video clips, group discussion, lecture with ppt, quiz | 10 |

Part D(Marks Distribution)

| | Ineory | | | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | | | |
| | Practical | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | | |
| | 0 | | | | | | | | | | | | |

Books End Articles https://www.forbes.com/entrepreneurs/?sh=3e2b77403035 References Books Effective Small Business Management by Scarborough & Zimmerer MOOC Courses https://nptel.ac.in/courses/110106141 Videos https://www.youtube.com/watch?v=N3-FZn_iQFU&E=3s

Course Articulation Matrix PO10 PO12 PSO3 COs PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO11 PSO1 PSO2 CO1 3 1 3 3 1 1 2 --1 1 _ 1 CO2 2 2 3 3 3 2 1 1 --_ -1 1 3 1 CO3 1 1 3 2 2 1 ---1 3 1 1 CO4 3 1 --2 2 1 -2 -3 3 3 CO5 1 2 ---1 1 -3 1 3 3 3 3 CO6 _ --_ -----



BSc_FoodTechnology

| Title of the Course | Intellectual | Property Rights [T] | | | | | | | | | |
|------------------------------------|---|---|-------------|-------------------------|----|--------|---|-------|--|--|--|
| Course Code | GE-IV [T] | | | | | | | | | | |
| | | | | Part A | | | | | | | |
| Voor | and | Somestor | 4th | Cradita | L | Т | Ρ | С | | | |
| Tear | 2110 | Semester | 401 | Credits | 4 | 0 | 0 | 4 | | | |
| Course Type | Theory onl | leory only | | | | | | | | | |
| Course Category | Generic El | eneric Elective | | | | | | | | | |
| Pre-Requisite/s | Knowledge of food businees managemnet, startups Co-Requisite/s To gain knowledge about rights for the protection of invention done in the project work. | | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.(BL1-Remember) CO2- To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act(BL2-Understand) CO3- Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.(BL3-Apply) CO4- The students once they complete their academic projects, they get awareness of acquiring the patent (BL4-Analyze) CO5- Further teacher of plagiarism in their innovations which can be questioned legally(BL5-Evaluate) | | | | | | | | | | |
| Coures Elements | Skill Devel Entreprene Employabi Professsor Gender X Human Val Environme | opment × eurship × lity ✓ nal Ethics ✓ lues × nt × | SDG (Goals) | SDG4(Quality education) | | | | | | | |
| | | | | Part B | | | | | | | |
| Modules | | | Contents | | Pe | lagogy | | Hours | | | |

| Theory | | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| 100 | 40 | 60 | 18 | 40 | | | | | | | |
| | | | Practical | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | |
| | | | | | | | | | | | |

| | Part E | | | | | | | | | |
|------------------|---|--|--|--|--|--|--|--|--|--|
| Books | Intellectual Property Rights and the Law, Gogia Law Agency, by Dr. G.B. Reddy . Law relating to Intellectual Property, Universal Law Publishing Co, by Dr. B.L.Wadehra | | | | | | | | | |
| Articles | | | | | | | | | | |
| References Books | | | | | | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/110105139 | | | | | | | | | |
| Videos | https://youtu.be/HX8_Udlwy58 | | | | | | | | | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 1 | 1 | 1 | 1 | 1 | - | - | 2 | - | 1 | 1 | - | 1 | 1 | 1 |
| CO2 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | - | 2 | - | - | 1 | 2 | 1 |
| CO3 | 2 | 2 | 1 | 1 | - | 1 | - | 2 | 1 | - | 2 | - | 2 | 2 | 1 |
| CO4 | 2 | 2 | 1 | 1 | 1 | - | 1 | - | - | 1 | - | - | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 1 | - | 1 | - | 1 | - | 1 | 2 | - | 1 | 2 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Cooperation M | Cooperation Marketing & Finance | | | | | | | | | | |
|------------------------------------|--|--|-----|---------|---|---|---|---|--|--|--|--|
| Course Code | SEC V | EC V | | | | | | | | | | |
| Part A | | | | | | | | | | | | |
| Voar | 3rd | Somostor | 5th | Credite | L | т | Р | С | | | | |
| Tear | 310 | Semester | 501 | Credits | 2 | 0 | 0 | 2 | | | | |
| Course Type | Theory only | Theory only | | | | | | | | | | |
| Course Category | Specialization | Specialization Elective Courses | | | | | | | | | | |
| Pre-Requisite/s | Student Shou entrepreneurs | Student Should acquainted with the basic knowledge of co-Requisite/s Student Should acquainted with the basic knowle business and startups | | | | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- CO1: Communicate with required clarity ensuring that the information communicated is clear and accurate(BL1-Remember) CO2- CO2: Comprehend and apply basic computer working, basic operating system and uses internet services to get accustomed & amp; take benefit of IT developments in the industry (BL2-Understand) CO3- CO3: To demonstrate knowledge of entrepreneurship and identify establishment for supporting the development of businesses/entrepreneurship. (BL3-Apply) CO4- CO4: To illustrate procedures to achieve a safe working environment in line with occupational health, safety, environment regulations.(BL4-Analyze) CO4- CO4: To illustrate industry (BL5-Evaluate) | | | | | | | | | | | |
| Coures Elements | Skill Development ✓ Entrepreneurship × Employability ✓ Professsonal Ethics ✓ Gender × Human Values × Environment × | | | | | | | | | | | |
| Part B | | | | | | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|--|---|-------|
| 1 | Concept of Entrepreneurship Definition of Entrepreneurship given by various economists the ideal definition –The conceptual model of Entrepreneurship given by John Kao. Views given by Schumpeter Walker & Drucker on Entrepreneurship - Entrepreneur and Manager -Enterprise and Entrepreneur. Managing Creativity Issues to be addressed in working the definition of creativity –Definition -Attributes of a creative person - Creative Thinking and Motivation - Managing Creativity - Organizational Actions that enhance and hinder Creativity -Organizational priorities and Creativity -Managerial responsibilities in a creative organization | Lecture method, audio/Video clips, group discussion, quiz | 8 |
| 2 | Definition of Small Business - Composition of Small Business- Economic Contribution of Small Business. Strategic Planning for Small Business - Steps in Strategic Planning - Develop a clear Mission Statement - Assess Organization Strangths - Conduct a thorough Market Segment Analysis - Analyze Competitors - Create Company Goals - Formulate Strategic Options and Select appropriate Strategies (Focus, Cost leadership & Differentiation) - Translate Strategic Plans into Action Plans-Establish accurate Controls. Why Strategic Planning fails in Small Business. Forms of Ownership: Sole Proprietorship, Partnership& Corporation form of Organization - Advantages and Disadvantages, Franchising- What is Franchising - Advantages and Disadvantages to Franchise Cvalues (Control Control Contracts - Types of Franchise arrangements. | lecture method, audio/video clips, group discussion, quiz | 8 |
| 3 | Introduction: Project - definition, features, types, infrastructure creation-a special type of projects, significance of infrastructure in economic development, bottlenecks in the infrastructure creation, Project Identification: Idea generation, Project screening, Feasibility study. The advantages and disadvantages of starting your business – The advantages and disadvantages of buying all existing business – Critical areas to be examined while buying all existing business - Detremining the value of a business – Financial Record Keeping – Profit Planning & Cost Control, Project costing: Breakdown structure of the project, cost estimation of the project, factor affecting the cost of the project, Costing with alternative configurations/specifications. Project Appraisal: technical appraisal, marketing appraisal, legal and environment appraisal, financial appraisal- cost estimation of the project and evaluating project using pay back and NPV, Detailed project report – introduction, Introduction to SCBA. | Audio/Video clips, group discussion, lecture with ppt, quiz | 8 |
| 4 | Arrangement of funds: Traditional sources of financing – Equity shares, preference shares, Debentures/bonds, loan from financial institutionsLoan syndication and consortium finance; Alternative sources of financing- Foreign Issue, FDI & FII, ECB, Private equity, Securitization, BOT projects, PPP, Venture capital / Incubation fund, Franchising etc; | Audio/Video clips, group discussion, lecture with ppt, quiz | 8 |
| 5 | Role played by various Financial Institutions like IDBI, ICICI and IFCI: Special Role played by SIDBI and Commercial Banks – Approval of term loan applications by Commercial Banks – How to decide about a suitable agency for assistance Role played by SFCR and NSIC; Project Implementation: Project contracts – Principles, practical aspects of contacts, legal aspects of project management, global tender, Negotiation for projects, Project insurance, Human resource management, network analysis | Audio/Video clips, group discussion, lecture with ppt, quiz | 8 |

| | Part D(Marks Distribution) | | | | | | | | |
|-------------|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|
| | Theory | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 100 | 40 | 60 | 18 | 40 | 0 | | | | |
| | | | Practical | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | | | | |

| Packa Seatherauth N.M. Wilson D. L. & Zimmann T. (2000. Issues) - Mining Small During Management | | | | | | |
|--|--|--|--|--|--|--|
| BOOKS | Scarborough, N. M., Wilson, D. L., & Zimmerer, T. (2009, January 1). Elective Smail Business Management. | | | | | |
| Articles | | | | | | |
| References Books | Desai, V. (2001, January 1). Dynamics of Entrepreneurial Development and Management. | | | | | |
| MOOC Courses | https://nptel.ac.in/courses/110106141 | | | | | |
| Videos | https://www.youtube.com/watch?v=N3-FZn_iQFU&t=3s | | | | | |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 3 | 1 | 1 | 1 | 1 | 2 | - | 1 | 1 | - | 1 | - | 3 | 1 | 1 |
| CO2 | 3 | 1 | 1 | - | 1 | 2 | 1 | 1 | - | 1 | - | - | 3 | 1 | 2 |
| CO3 | 3 | 1 | 1 | 2 | - | 1 | - | 1 | - | 1 | 2 | - | 3 | 1 | 2 |
| CO4 | 3 | 2 | 1 | - | - | - | 1 | 2 | 1 | - | - | - | 3 | 1 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | - | 3 | 2 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



Bsc_Microbiology

| Title of the Course | Organic Farming | Organic Farming | | | | | | | |
|------------------------------------|---|--|----------------|----------------|---|---|---|---|--|
| Course Code | SEC V (T) | EC V (T) | | | | | | | |
| | Part A | | | | | | | | |
| Veer | View Data Demotra Eth Devella | | | | | | | С | |
| Tear | 310 | Semester | 501 | Credits | 2 | 0 | 1 | 3 | |
| Course Type | Embedded theory | mbedded theory and lab | | | | | | | |
| Course Category | Skill Enhancemen | Skill Enhancement Courses | | | | | | | |
| Pre-Requisite/s | Student must be | aware of basic plant physiology and soil | classification | Co-Requisite/s | | | | | |
| Course Outcomes & Bloom's Level | rse Outcomes ilcom's Level CO2- Students will understand various principles, need and prospect of organic farming including the importance of sustainability, biodiversity and ecological balance. (BL2- Understand) CO2- To equip learners with the knowledge and skills necessary to practice sustainable agriculture and the production of healthy, organic food(BL2-Understand) CO3- Students will gain hands on experience through field work, farm visits or practical exercises to apply their knowledge in a real world setting(BL3-Apply) CO4- learners will explore the significance of soil health in organic farming and various methods to enhance soil fertility through composting and crop rotation. (BL4-Analyze) CO5- Students will explore the significance of soil health in organic farming and various methods to enhance soil fertility through composting and crop rotation. (BL4-Analyze) CO5- Students will explore the significance of soil health in organic farming and various methods to enhance soil fertility through composting and crop rotation. (BL4-Analyze) | | | | | | | | |
| Coures Elements | Skill Development ✓ SDG (Content) Entrepreneurship ✓ SDG3(Good health and well-being) Employability ✓ SDG4(Quality education) Professional Ethics ✓ SDG (Goals) Gender X SDG3(Content) Human Values X SDG4(Content) Environment ✓ SDG1(Sustainable cities and economics) SDG1(Climate action) SDG3(Content) | | | | | | | | |

| | Part B | | | | | | | | | |
|---------|---|--|---|--|--|--|--|--|--|--|
| Modules | Contents | Pedagogy | | | | | | | | |
| I | History and development, IFOAM Definition and Principle- health, fairness, ecology and care,Methods, advantages and limitations, Need of Organic farming in present context and future prospects- barrier | Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings | 7 | | | | | | | |
| П | ORGANIC ECOSYSTEM & THEIR CONCEPT Structure and function, Productivity, Decomposition, Nutrient cycling, Eutrophication, Biological magnification | Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings | 8 | | | | | | | |
| 111 | SOIL Definition, Composition of Soil- Soil texture and Types, Soil structure, Soil Profile, Humus & Soil pH,Role of Soil in Organic Farming,Soil factors affecting plant Growth: light, heat, water,humidity, pH and Nutrition,C: N ratio of good fertile Soil | Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings | 7 | | | | | | | |
| IV | PLANT NUTRITION □ Structural organization & function of different Plant organ,Plant nutrient- Micro and Macro, Importance & Deficiency,Symptoms,Sources : Organic, Green manure- Method of composting,Benefit & Limitations,oil microorganism: Mycorrhiza, Rhizosphere- Significance | Lecture methods, group discussions, demonstrations, field work, experiments, ABL, PBL, Trainings | 8 | | | | | | | |

| | Part C | | | | | | | | | | |
|---------|---|--|---------------|---------|--|--|--|--|--|--|--|
| Modules | Title | Indicative-ABCA/PBL/ Experiments/Field work/ Internships | Bloom's Level | Hours | | | | | | | |
| 1 | Visit to Organic farm to study the various components, identification and utilization of Organic products. | Field work | | 6 | | | | | | | |
| 11 | Preparation of Organic Compost-Over ground compost, Pit compost, Liquid compost, Vermi compost. | PBL | BL3-Apply | 1 MONTH | | | | | | | |
| Ш | Preparation of Neem products and other botanicals for Pest and disease control | Internships | BL6-Create | 1 MONTH | | | | | | | |
| IV | Weed control through organic way | Experiments | BL3-Apply | 30 days | | | | | | | |
| V | Soil analysis: pH determination. | Experiments | BL4-Analyze | 2 | | | | | | | |
| VI | Seed bed preparation, seed selection and seedling preparation | Experiments | BL3-Apply | 1 WEEK | | | | | | | |
| VII | Method of application of different types of fertilizer and Green manure. | PBL | BL3-Apply | 1 MONTH | | | | | | | |
| VIII | Preparation of Panchagawa/ Amrit Iol | PBI | BI 6-Create | 1 MONTH | | | | | | | |

| | Part D(Marks Distribution) | | | | | | | | | |
|--|----------------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| | Theory | | | | | | | | | |
| Total Marks Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation Min. In | | | | | | | | | | |
| 100 | 40 | 60 | 60 18 | | | | | | | |
| | | | Practical | · | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 100 | 50 | 60 | 30 | 40 | | | | | | |

| | Part E |
|------------------|---|
| Books | Sharma, Arun K. 2002. A Handbook of Organic farming. Agrobios, India. Sathe, T.V. 2004, Vermiculture and Organic Farming. Daya Publishers Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India. Dr. Pratiksha Raghuvanoki. Handbook of Organic Farming |
| Articles | https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/organic-farming |
| References Books | Dongarjal R. P. and Zade S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India. |
| MOOC Courses | https://nptel.ac.in/courses/126105014 |
| Videos | https://nptel.ac.in/courses/126105014 |

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 1 | 2 | 1 | 1 | 2 | - | - | - | - | - | - | 2 | 2 | 2 |
| CO2 | 1 | 2 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | 2 | 1 | 2 |
| CO3 | 1 | 1 | 1 | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 |
| CO4 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 2 | 1 | 2 |
| CO5 | 3 | 1 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | 1 | 2 | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_PCM

| Title of the Course | SEC-2 | | | | | | | | | |
|------------------------------------|---|--|--|--|-------------------------------------|-----------------------------|----------------------------|-------------------------------------|--|--|
| Course Code | SEC0201 | | | | | | | | | |
| | L | | Part A | | | | | | | |
| Voar | 1 of | Samastar | and | Cradita | L | т | Р | С | | |
| leal | 151 | ist Semester | 2110 | Credits | 24 | 0 | 0 | 24 | | |
| Course Type | Theory only | Theory only | | | | | | | | |
| Course Category | Humanities, S | Humanities, Social Sciences and Management | | | | | | | | |
| Pre-Requisite/s | | | | Co-Requisite/s | | | | | | |
| Course Outcomes & Bloom's Level | CO1- 1.At the making of Indi for being a go | end of this course, students would ia as a nation . 3.The students will od and concerned Indian citizen (I | d be intellectually well equippe have an understanding of salie 3L5-Evaluate) | d to have a sense of modern Indian history an ent features of modern India . 4.It will help stu | d culture . 2. T dents to develo | he students p their pers | will have a onality and | n understanding of thinking horizon | | |
| Coures Elements | Skill Developr Entrepreneurs Employability Professsonal Gender X Human Value: Environment 2 | ment × ship × Ethics ✓ s ✓ | SDG (Goals) | SDG4(Quality education) SDG5(Gender equality) SDG11(Sustainable cities and economies) SDG15(Life on land) | | | | | | |

Part B

| Modules | Contents | Pedagogy | Hours |
|---------|--|---------------------|-------|
| 5 | 1. Idea of India in historical perspective a) Indian culture, b) cultural commonness, c)cultural diversities, d)unity in diversity, e) cultural accomodations, f) cultural conflicts, g)Idea of India and British Rule, h) Role of Indian Intelligentsia. 2. Emergence and growth of Indian Nationalism a) Anti-colonial basis, b) Economic Nationalism, c) communalism and nationalism, d) revivalism and Indian nationalism, e)Enlightenment values, f)European Nationalism and Indian Nationalism. 3. Social Reform Movements a) British Rule and Indian Introspection, b)Raja Rammohan Roy, c) social reform movements in 19th century, d)Swami Vivekanand, e)The women issue, f)Caste system 4. Indian National Movement a)Early Revolts and 1857 Revolt, b)Early Nationalists, c) Bang Bhang Movement a)Early Revolts and 1857 Revolt, b)Early Nationalists, c) Bang Bhang Movement, d) Gandhi led Mass Movements, e) Socialist and Left trends, f) Princely States and their integration into nation, h)Partition and Independence - 5. India after independence a)Making of Indian Constitution, b) Post Independent estimates of Indian econny- From Planning to LPG, e) Achievements, f) Challenges in 21st century India. | Class room Lecuters | 24 |

Part D(Marks Distribution)

Γ

| | | | | Theory | |
|----------------|-----------------------------|------------------------|--------------------------------|---|-----------------------------|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation |
| None | 0 | 0 | None | None | None |
| | | | | Practical | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation |
| None | 0 | 0 | None | 1. Bipan Chandra and others: India's Struggle For Independence, Penguine Publishers. 2. Bipan Chandra: History Of Modern India, Orient Blackswan publishers. 3. Sunil Khilnani: The Idea of India, Penguine publishers. 4. Shekhar Bandopadhyay: From Plastic to Partition and After, A History of Modern India, Orient Blackswan publishers. 5. Rakesh Batabyal: The Penguine Book of Modern Indian Speeches, 1878 to Persent, Penguine Publishers. 6. A R Desai:Social Background of Indian Nationalism, Popular Prakashan. 7. B R Nanda: Mahatma Gandhi , A BiographyLondon 8. B.R.Nanda:Gandhi and His Critics, Oxford 9. Girja Shankar: Socialist Trends in Indian National Movement, Meerut 10. Urmila Phadnis:Towards the integration of Indian States, 1919-1947.Mumbai 11. Bimal Prasad: Gandhi, Nehru and J.P.A Study in Leadership, New Delhi 12. Bipan Chandra and others:India Since Independence , Penguine 13. Ramchandra Guha:Makers of Modern India, Penguine. 14. Austin Granville: The Indian Constitution, Oxford | None |

Part E

| Books | None |
|------------------|------|
| Articles | |
| References Books | None |
| MOOC Courses | None |
| Videos | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_ComputerScience

| Title of the Course | SEC-2 | | | | | | | | |
|------------------------------------|--|---|-------------|--|----|---|---|----|--|
| Course Code | SEC0201 | | | | | | | | |
| | | | | | | | | | |
| | | | | | L | Т | Р | С | |
| Year | 1st | Semester | 2nd | Credits | 24 | 0 | 0 | 24 | |
| Course Type | Theory only | | | | | | | | |
| Course Category | Humanities, Social Sciences and Management | | | | | | | | |
| Pre-Requisite/s | | | | Co-Requisite/s | | | | | |
| Course Outcomes & Bloom's Level | CO1- 1.At the end of this course, students would be intellectually well equipped to have a sense of modern Indian history and culture . 2. The students will have an understanding of making of India as a nation . 3.The students will have an understanding of salient features of modern India . 4.It will help students to develop their personality and thinking horizon for being a good and concerned Indian citizen (BL5-Evaluate) | | | | | | | | |
| Coures Elements | Skill Developm Entrepreneurs Employability 3 Professsonal E Gender X Human Values Environment > | nent X hip X X Ethics ✓ S ✓ | SDG (Goals) | SDG4(Quality education) SDG5(Gender equality) SDG11(Sustainable cities and economies) SDG15(Life on land) | | | | | |

Part B

| Modules | Contents | Pedagogy | Hours |
|---------|---|---------------------|-------|
| 5 | 1. Idea of India in historical perspective a) Indian culture, b) cultural commonness, c)cultural diversities, d)unity in diversity, e) cultural accomodations, f) cultural conflicts, g)Idea of India and British Rule, h) Role of Indian Intelligentsia. 2. Emergence and growth of Indian Nationalism a) Anti-colonial basis, b) Economic Nationalism, c) communalism and nationalism a) Anti-colonial basis, b) Economic Nationalism, c) communalism and nationalism, a) drevivalism and Indian nationalism. 3. Social Reform Movements a) British Rule and Indian Introspection, b)Raja Rammohan Roy, c) social reform movements in 19th century, d)Swami Vivekanand, e)The women issue, f)Caste system 4. Indian National Movement a)Early Revolts and 1857 Revolt, b)Early Nationalists, c) Bang Bhang Movement, a) Gandhi led Mass Movements, e) Socialist and Left trends, f) Princely States and their integration into nation, h)Partition and Independence - 5. India after independence a)Making of Indian Constitution, b) Post Independent es. f, localist accommy- From Planning to LPG, e) Achievements, f) Challenges in 21st century India. | Class room Lecuters | 24 |

Part D(Marks Distribution)

Γ

| | | | | Theory | |
|----------------|-----------------------------|------------------------|--------------------------------|---|-----------------------------|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation |
| None | 0 | 0 | None | None | None |
| | | | | Practical | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation |
| None | 0 | 0 | None | 1. Bipan Chandra and others: India's Struggle For Independence, Penguine Publishers. 2. Bipan Chandra: History Of Modern India, Orient Blackswan publishers. 3. Sunil Khiinani: The Idea of India, Penguine publishers. 4. Shekhar Bandopadhyay: From Plastic to Partition and After, A History of Modern India, Orient Blackswan publishers. 5. Rakesh Batabyai: The Penguine Book of Modern Indian Speeches, 1878 to Present, Penguine Publishers. 6. A R Desai:Social Background of Indian Nationalism, Popular Prakashan. 7. B R Nanda: Mahatma Gandhi , A Biography,London 8. B.R.Nanda:Gandhi and His Critics, Oxford 9. Girja Shankar: Socialist Trends in Indian National Movement, Meerut 10. Urmila Phadnis:Towards the integration of Indian States,1919- 1947,Mumbai 11. Bimal Prasad: Gandhi,Nehru and J.P.A Study in Leadership,New Delhi 12. Bipan Chandra and others:India Since Independence ,Penguine 13. Ramchandra Guha:Makers of Modern India, Penguine. 14. Austin Granville: The Indian Constitution, Oxford | None |

| Books | None |
|------------------|------|
| Articles | |
| References Books | None |
| MOOC Courses | None |
| Videos | |

| | | | | | | | Cours | e Articulatio | on Matrix | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-------|---------------|-----------|------|------|------|------|------|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_FoodTechnology

| Title of the Course | Food a | nd International Tr | rade [T] | | | | | | |
|------------------------------------|---|--|---|---|---|---|----------------------------------|----------|--|
| Course Code | VAC-IV | [T] | | | | | | | |
| | Part A | | | | | | | | |
| Vaar | and Semester 4th | | 446 | Credite | L | т | Р | С | |
| Tear | Zna | Semester | 4th Creats | 2 | 0 | 0 | 2 | | |
| Course Type | Theory only | | | | | | | | |
| Course Category | Interdisciplinary Minor | | | | | | | | |
| Pre-Requisite/s | Knowledge of Food Laws and regulations | | | Co-Requisite/s | knowledge of exports, related policies, tariffs, competition; characteristics of international markets and trade | | | | |
| Course Outcomes & Bloom's Level | CO1- ti CO2- ti CO3- Ti CO4- Ti CO5- ti | o understand the t o acknowledge the io demonstrate kn io illustrate the wc o apply for and ta | food production e characteristics owledge of expo orking of various ke benefits of go | and consumption patterns and trends in India of international markets and trade(BL2-Und orts, related policies, tariffs, competition, etc B regional trade alliances and markets and imp overnment schemes to promote international tr | as well as in world(BL erstand) BL3-Apply) lementation of internat rade in food businesse | .1-Remember) ional standards for harn s(BL5-Evaluate) | nony in food trade (BL4-/ | Analyze) | |
| Coures Elements | Skill Development X SDG1(No poverty) Entrepreneurship X SDG2(Zero hunger) Employability X SDG3(Good health and well-being) Professsonal Ethics ✓ SDG4(Quality education) Gender X SDG4(Clean water and sanitation) Human Values X SDG9(Industry Innovation and Infrastructure) SDG12(Responsible consuption and production) | | | | | | | | |

| | | Part B | |
|---------|--|--|-------|
| Modules | Contents | Pedagogy | Hours |
| 1 | Food production trends in India and world - Different kinds of food industries, their market size and components of food industries; major growing areas of cereals, pulses, fruits, vegetables, milk, tea, coffee, meat, eggs, etc. in India and World. World consumption of food: Patterns and types of food consumption across the globe | Group discussion, lecture method, quiz | 06 |
| 2 | International marketing and international trade, salient features of international marketing; Composition & direction of Indian exports, international marketing environment, Deciding when & how to enter international market, Foreign Exchange markets | lecture method, quiz | 06 |
| 3 | Exports- Direct exports, indirect exports, Licensing, Joint ventures, Direct investment, India's ex-im policy, International trade theories. Absolute advantage, Comparative advantage, Trade tariffs. Subsidies. Quotas. Dumping. | Audio/Video clips, group discussion, lecture method | 07 |
| 4 | Regional trade alliances and markets- OECD, EEU, ASEAN, SAARC, NAFTA And Africa Union, International standards- ISO, Codex Alementarius, FAO, WTO and world trade agreements related to food business | Audio/Video clips, group discussion, lecture method | 06 |
| 5 | Government intervention in the trade of food products; Government institutions related to international food trade: APEDA, MPEDA, Tea Board, Spice Board, MOFPI, etc. Case Study: Food loss in international trade, Indonesia tuna exported to European Union, US, and Japan; Local Food Supply Chains | Audio/Video clips, group discussion, lecture with ppt, Review Analysis | 05 |

| | | | Theory | | |
|---|-----------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Total Marks Minimum Passing Marks External Evaluation Min. Ex | | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | |
| 100 | 40 | 60 | 18 | 40 | |
| | | | Practical | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation |
| | | | | | |

| Part E |
|--------|
|--------|

| Books | John Daniels, Lee Radebaugh, Brigham, Daniel Sullivan; International Business by Pearson Education |
|------------------|--|
| Articles | |
| References Books | Aswathappa; International Business by Tata McGraw-Hill Education, New Delhi. |
| MOOC Courses | https://nptel.ac.in/courses/126105336 |
| Videos | |

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | 1 | - | 2 | 1 | 2 |
| CO2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | - | - | - | 1 | - | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 2 | - | - | 1 | - | 2 | 1 | - | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | - | 1 | - | 1 | - | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 1 | - | - | 2 | - | 1 | 1 | - | 3 | 3 | 3 |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |



BSc_PCM

| Title of the Course | India in 21st centuary | | | | | | | | | | | |
|------------------------------------|---|---|---|---|---|---|---------------------------------------|---|--|--|--|--|
| Course Code | VAC0101[T] | VAC0101[T] | | | | | | | | | | |
| | VACOIDI[1] | | | | | | | | | | | |
| | 1 | | Part | A | 1 | 1 | 1 | | | | | |
| Year | 1st | Semester | 1st | Credits | L | Т | Р | С | | | | |
| | | | | | 2 | 00 | 00 | 2 | | | | |
| Course Type | Theory only | Theory only | | | | | | | | | | |
| Course Category | Skill Enhand | Skill Enhancement Courses | | | | | | | | | | |
| Pre-Requisite/s | 1. *Understa knowledge c composition understandii the history o crucial for cc Revolt of 18 phases of th the birth of ti Movements ² particularly t Familiarity w and the Quit Indian freedu Era [*] : Underr independen planned pro- towards libe from differer understandi Awareness [*] environment and sustaina impact on n effectively. | Inding of Sociological Concepts of sociological concepts is esser of Indian society discussed in I tegration. 2. "Historical Backgn f India, particularly the Indian F1 morrehending Unit II. Knowledg 57, the emergence of nationalis e freedom struggle provides co he Indian nation-state. 3. "Awar ": A basic understanding of politi India movement aids in analyz om and partition. 4. "Knowledg standing the phases of nationalis radization and globalization. Kno t sociatal groups and regions e u of India's post-independence : Unit V delves into global contion. And a lissues, globalization, and me bility. A broad understanding of ations is necessary to engage w | *: A foundational trial to grasp the Jnit I. This includes vironments, and threats ound": Familiarity with reedom Movement, is e of events such as the e of events such as the encess of Political cal movements in India, is necessary for Unit III. on, civil disobedience, ing the dynamics of e of Post-Independence uiding since es awareness of the the paradigm shift wiedge of responses nriches the journey. 5. *Global zms such as wements for democracy iglobal trends and their ith this content | Co-Requisite/s | 1. "Foundational Understanding of Sociological Concept Understanding social institutions, cultural environments, threats to national integration is fundamental Familiari sociological theories such as functionalism, conflict theo symbolic interactionism can provide a deeper comprehe of societal dynamics. 2. "Historical Context of India": - Knowledge of Indian history, including the colonial perior struggle for independence, and post-independence developments, offers context for understanding the evol Indian society Understanding the socio-economic impo- colonial India and the role of various stateholders in India": history, including the colonial perior struggle for independence, and post-independence enhance insight into contemporary social issues. 3. "Understandin Political Movements in India": - Knowledge drey figure ideologies, and strategies of political movements in India including those led by Gandhi, Nehru, and duter promin leaders, is essential Awareness of the socio-political c of colonial India and the role of various stakeholders in to struggle for independence enriches understanding. 4. "Familiarity with Post-Independence Developments": - Understanding the socio-economic and political changes post-independence India, including the Nehruvian era, economic reforms, and social movements, is crucial. Awareness of key policies, such as the Green Revolutio reservation system, and economic liberalizaton, provide insights into contemporary Indian society, 5. "Global Perspective and Awareness": - Knowledge of global trer areas such as technology, economics, environment, and geopolitics enhances (interational fuede, and human rights movement change, interrational Irade, and human rights movement change, interrational Irade, and human rights movement | | | | | | | |
| Course Outcomes & Bloom's Level | CO1- 1. Stur CO2- 2. Stur CO3- 3. Stur CO4- 4. Stur constitution(| dents are able to define, identify dents are able to summarize an dents are able to evaluate India dents are able to write the histo BL6-Create) | and explain the process of d extract the time before In society, Its nature and ago rical accounts that shaped | of Indian Freedom movement and developme dependence and after Independence India.() encies of social change with reference to mod the very nature and character of 20 and 21 s | nt of political I BL2-Understa lernization.(BI t century India | nstitutions.(BL1-R and) L5-Evaluate) a with reference to | emember) Nation Building an | d | | | | |
| Coures Elements | Skill Develop Entrepreneu Employabilit Professsona Gender ✓ Human Valu Environmen | oment ✓ rship × y × I Ethics ✓ es ✓ t × | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and produc SDG13(Climate action) | ction) | | | | | | | |
| | | | Part I | В | | | | | | | | |

| Modules | Contents | Pedagogy | Hours |
|---------|---|---|-------|
| 1 | Composition of Indian Society Society. (a) Introduction of Nature of India society and Indian nation state. (b) Major Social Institutions and Organization and threats to national integration (c) Social and Cultural Environment of India Society in 19th ,20th and 21st century. | Lectures and visual PowerPoint slides Students read text and commentary on assigned topics as well as published research articles before the lectures Students read cases discussed in the text-books, as well as more detailed articles. Students participate in class discussions to crystallize the concepts | 5 |
| 2 | Unit II Indian Freedom Movement- emergence. 5 1) Revolt of 1857, Rise of nationalism & Birth of Congress 2). Partition of Bengal & swadeshi movement, Home rule movement Round table conferences 3) Revolutionary movements, Gandhian movements (i) Non-Cooperation (ii) Civil Disobedience (iii) Quit India movement | Lectures and visual PowerPoint slides • Students read text and commentary on assigned topics as well as published research articles before the lectures • Students read cases discussed in the text-books, as well as more detailed articles. • Students participate in class discussions to crystallize the concepts | 5 |
| 3 | Unit 3 Indian freedom and Partition 5 1.) Communalism – Rise & spread (11.) Muslim league & its politics , Hindu communalism . 111.) India's partition & independence References | Lectures and visual PowerPoint slides Students read text and commentary on assigned topics as well as published research articles before the lectures Students read cases discussed in the text-books, as well as more detailed articles. Students participate in class discussions to crystallize the concepts | 5 |
| 4 | UNIT IV Nation building Since Independence 5 3 stages of making of the Indian Nation state: - 3. Era of planned progress. (1951-1971) Period of Populist policies and programmes (1971 to 1992) Period of paradigm shift towards liberalization and globalization (since 1992). Responses of various classes, communities and regions. | Lectures and visual PowerPoint slides • Students read text and commentary on assigned topics as well as published research articles before the lectures • Students read cases discussed in the text-books, as well as more detailed articles. • Students participate in class discussions to crystallize the concepts | 5 |
| 5 | Unit V Nation Building and Global Concern 5 a. Environmental concerns in 21st century b. Question of Globalization and its Impact c. Global Movement for Democracy and sustainability | Lectures and visual PowerPoint slides • Students read text and commentary on assigned topics as well as published research articles before the lectures • Students read cases discussed in the text-books, as well as more detailed articles. • Students participate in class discussions to crystallize the concepts | 4 |

Part D(Marks Distribution)

| Theory | | | | | | | | | | | | |
|-------------|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|--|--|
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 100 | 40 | 40 | 12 | 60 | 28 | | | | | | | |
| Practical | | | | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | | | |
| 00 | 00 | 00 | | 00 | | | | | | | | |

Books 1. Bose, N.K. 1967, Culture and Society in India. Bombay: Asia Publishing House 2. Dube, S.C. 1990, Indian village (New Delhi: National Book Trust.) 3. Percival Spear : History of Indian Society , Penguin , 1966. 4. Uberoi, Patrica : Family , kinship and Marriage , New Delhi : oxford University Press , 1995 , PP 50 to 73 , 416 to 451 5. Gandhi , M K : Removal of Untouchability , Navjeevan Publishing House , Ahmadabad , 1954 Articles References Books 1. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak. MOOC Courses 1. https://www.youtube.com/watch?v=i8N6YRTJsDk 2. https://youtu.be/MWsT7x3qd3E 3.https://www.youtube.com/watch?v=pQghqJSUAK4&list= 4.https://youtu.be/9BEU8A_JZPU 5.https://youtu.be/PSKQwaZ4dg

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 |
| CO2 | - | - | - | - | - | 1 | - | - | 2 | - | - | - | 1 | 1 | 1 |
| CO3 | - | - | - | - | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 1 |
| CO4 | - | - | - | - | - | 1 | - | - | - | - | - | - | 2 | 1 | 2 |
| CO5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |


Syllabus-2023-2024

BSc_ComputerScience

| Title of the Course | India in 21st centuary | | | | | | | | | | |
|------------------------------------|---|--|--|--|--|--|--|---|--|--|--|
| Course Code | VAC0101[T] | | | | | | | | | | |
| Part A | | | | | | | | | | | |
| Veer | 1 at | Somester | 1.01 | Cradita | L | т | Р | С | | | |
| rear | TSL | Semester | ist | Credits | 2 | 0 | 0 | 2 | | | |
| Course Type | Theory only | | · | | | | | | | | |
| Course Category | Add-On Courses | | | | | | | | | | |
| Pre-Requisite/s | *Understandin knowledge o composition understandin to national in the history of crucial for co Revolt of 185 phases of the the birth of th Movements⁺ particularly th Familiarity with and the Quit Indian freedc Era*: Unders independence planned proce towards liber from differen understandin Awareness⁺: environment and sustainal impact on na effectively. | nding of Sociological Concepts f sociological concepts is esse of Indian society discussed in g social institutions, cultural e tegration. 2. "Historical Backg India, particularly the Indian F mprehending Unit II. Knowled 57, the emergence of nationali f freedom struggle provides cc le Indian nation-state. 3. "Awa A basic understanding of poli tose led by figures like Gandh tht concepts like non-cooperati India movement aids in analyz m and partition. 4. "Knowledg tanding the phases of nation-fi e is vital for Unit IV. This inclu press era, populist policies, and alization and globalization. Kn t societal groups and regions e g of India's post-independence Unit V delves into global condin, and m bility. A broad understanding o tions is necessary to engage v | s*: A foundational ntial to grasp the Unit I. This includes ivironments, and threats ound": Familiarity with reedom Movement, is ge of events such as the sm, and the various mitext for understanding reness of Political ical movements in India, is necessary for Unit III. on, civil disobedience, ting the dynamics of e of Post-Independence suilding since les awareness of the 1 the paradigm shift owledge of responses uniches the e journey, 5. "Global erns such as ovements for democracy f global trends and their with this content | Co-Requisite/s | Here are fiv "Foundation" Understand threats to na sociological symbolic int socictal dym of Indian his independen context for 1 Understand the transitio contempora Movements and strategi led by Ganc essential J India and th independen economic au including th movements Green Revc liberalization society. 5. */ global trend environmen position in tt climate chau movements and vice ver | co-requisite al Understan g social insi titonal integr theories suck aractionism c armics. 2. "Hi theories suck aractionism c armonism c armonism c theory, including theory, including the socio- to indepenent to indepenent to indepenent so of political thi, Nehru, an wareness of a role of varice so of political this of varices are enriches u ce enriches u ce enriches u ce developm d political ch Nehruvian e Slobal Perspa in a reas suck an ageopol e global con ternatal suck an ad the stud sa. | s for the course c ding of Sociologic titutions, cultural el titon is fundamen as functionalism an provide a dee storical Context o y the colonial peri independence de lence enhances i the evolution of economic impact lence enhances i lence enhances i es 3. "Understan nowledge of key f the socio-politic sus stakeholders : understanding. 4. enetts" - Understan anges in post-ind ersts" - Understan anges in post-ind ersts" - Understan anges in post-ind ersts" - Understan anges in post-ind excitive and Awarei chas technology, titos enhances un entst - understand, and entarde, and hu ents to analyze th | sutlined: 1. al Concepts": - nvironments, and tal Familiarity with , conflict theory, and per comprehension of I India": - Knowledge to d; the struggle for velopments, offers Indian society s of colonial rule and nsight into ding of Political dia, including those t leaders, is i deontext of colonial in the struggle for "Familiarity with Post- familiarity with Post- familiarity with Post- noling the socio- ependence India, policies, such as the e economics, derstanding of India's ling global issues like iman rights eier impact on India | | | |
| Course Outcomes & Bloom's Level | CO1- 1. Stud CO2- 2. Stud CO3- 3. Stud CO4- 4. Stud constitution(E | ents are able to define, identif dents are able to summarize ar lents are able to evaluate India fents are able to write the histo BL6-Create) | y and explain the process nd extract the time before I a society, Its nature and ag prical accounts that shaped | of Indian Freedom movement and developm ndependence and after Independence India encies of social change with reference to m the very nature and character of 20 and 21 | nent of political .(BL2-Underst odernization.(B st century India | nstitutions.(E and) L5-Evaluate) a with referen | L1-Remember) ce to Nation Build | ling and | | | |
| Coures Elements | Skill Develop Entrepreneur Employability Professsonal Gender ✓ Human Value Environment | oment ✓ rship × / X Ethics ✓ es ✓ × | SDG (Goals) | SDG3(Good health and well-being) SDG4(Quality education) SDG5(Gender equality) SDG10(Reduced inequalities) SDG12(Responsible consuption and produ SDG13(Climate action) | uction) | | | | | | |

| | Part B | | | | | | | | | | |
|---------|--|---|---|--|--|--|--|--|--|--|--|
| Modules | Contents | Pedagogy | | | | | | | | | |
| 1 | Composition of Indian Society Society- (a) Introduction of Nature of India society and Indian nation state. (b) Major Social Institutions and Organization and threats to national integration (c) Social and Cultural Environment of India Society in 19th ,20th and 21st century. | Lectures and visual PowerPoint slides Students read text and commentary on assigned topics as well as published research articles before the lectures Students read cases discussed in the text-books, as well as more detailed articles. Students participate in class discussions to crystallize the concepts | 5 | | | | | | | | |
| 2 | Unit II Indian Freedom Movement- emergence. 1) Revolt of 1857, Rise of nationalism & Birth of Congress 2). Partition of Bengal & swadeshi movement, Home rule movement Round table conferences 3) Revolutionary movements, Gandhian movements (i) Non- Cooperation (ii) Civil Disobedience (iii) Quit India movement | Lectures and visual PowerPoint slides • Students read text and commentary on assigned topics as well as published research articles before the lectures • Students read cases discussed in the text-books, as well as more detailed articles. • Students participate in class discussions to crystallize the concept | 5 | | | | | | | | |
| 3 | Unit 3 Indian freedom and Partition 1.) Communalism – Rise & spread (11.) Muslim league & its politics , Hindu communalism . 111.) India's partition & independence References | Lectures and visual PowerPoint slides Students read text and commentary on assigned topics as well as published research articles before the lectures Students read cases discussed in the text-books, as well as more detailed articles. Students participate in class discussions to crystallize the concept | 5 | | | | | | | | |
| 4 | UNIT IV Nation building Since Independence 3 stages of making of the Indian Nation state: Era of planned progress. (1951-1971) Period of Populist policies and programmes (1971 to 1992) Period of paradigm shift towards liberalization and globalization (since 1992). Responses of various classes, communities and regions. | Lectures and visual PowerPoint slides • Students read text and commentary on assigned topics as well as published research articles before the lectures • Students read cases discussed in the text-books, as well as more detailed articles. • Students participate in class discussions to crystallize the concept | 5 | | | | | | | | |
| 5 | Unit V Nation Building and Global Concern a. Environmental concerns in 21st century b. Question of Globalization and its Impact c. Global Movement for Democracy and sustainability | Lectures and visual PowerPoint slides Students read text and commentary on assigned topics as well as published research articles before the lectures Students read cases discussed in the text-books, as well as more detailed articles. Students participate in class discussions to crystallize the concept | 4 | | | | | | | | |
| | | Part C | | | | | | | | | |

| F | Par | t |
|---|-----|---|
| | | |

t C Indicative-ABCA/PBL/ Experiments/Field work/ Internships Bloom's Level Modules Title Hours 1 Quiz & Flip Class room PBL 2

| Part D(Marks Distribution) | | | | | | | | | | |
|--|-----------------------|---------------------|--------------------------|---------------------|--------------------------|--|--|--|--|--|
| Theory | | | | | | | | | | |
| Total Marks Minimum Passing Marks External Evaluation Min. External Evaluation Internal Evaluation | | | | | | | | | | |
| 100 | 40 60 | | 28 | 40 | 12 | | | | | |
| | Practical | | | | | | | | | |
| Total Marks | Minimum Passing Marks | External Evaluation | Min. External Evaluation | Internal Evaluation | Min. Internal Evaluation | | | | | |
| 00 | 00 | 00 | | 00 | | | | | | |

| | Part E | | | | | | |
|--|---|--|--|--|--|--|--|
| Books 1. Bose, N.K. 1967, Culture and Society in India. Bombay: Asia Publishing House 2. Dube, S.C. 1990, Indian village. (New Delhi: National Book Trust.) 3. Percival Spear Indian Society, Penguin, 1966. 4. Uberoi, Patrica : Family, kinship and Marriage, New Delhi : oxford University Press, 1995, PP 50 to 73, 416 to 451 5. Gandhi, M P of Untouchability, Navjeevan Publishing House, Ahmadabad, 1954 | | | | | | | |
| Articles | | | | | | | |
| References Books | 1. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak. | | | | | | |
| MOOC Courses | | | | | | | |
| Videos | 1.https://www.youtube.com/watch?v=i8N6YRTJsDk 2. https://youtu.be/MWsT7x3qd3E 3.https://www.youtube.com/watch?v=pQghqJSUAK4&list= 4.https://youtu.be/9BEU8A_JZPU 5.https://youtu.be/PPsKQwaZ4dg | | | | | | |

Course Articulation Matrix

| COs | P01 | PO2 | PO3 | PO4 | PO5 | PO6 | P07 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | - | - | - | - | - | 2 | 2 | 2 | 1 | 1 | - | 2 | 1 | - | - |
| CO2 | - | - | - | - | - | 1 | 2 | 2 | 1 | 2 | - | 1 | - | - | - |
| CO3 | - | - | - | - | - | 1 | 2 | 1 | 1 | 1 | - | 1 | - | 1 | 1 |
| CO4 | - | - | - | - | - | 1 | 3 | 1 | 1 | 1 | - | 1 | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |