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**SYLLABUS**

**1. M. Sc. BIOCHEMISTRY**

**2. M. Sc. BIO TECHNOLOGY**

**3. M. Sc. MICROBIOLOGY**

**GYAN VIHAR SCHOOL OF SCIENCES**

**EDITION 2015**

**GYAN VIHAR SCHOOL OF SCIENCE**

**M.Sc. Biotechnology/Microbiology/Biochemistry**

**1. Need objectives and main features of curriculum**

Curriculums of M.Sc. Biochemistry/Biotechnology/Microbiology are designed to provide Biochemist, Biotechnologist, Microbiologist and a good Researcher to the science world & society at large. .It would not only provide an understanding but would also add on to their knowledge. The application of various tool and techniques in the field of Biochemistry/Biotechnology/Microbiology. The objective of designing this curriculum for the student is to update student’s knowledge about:

1. Living system and their interaction with technology to generate things of utility of mankind.

2. Encouraging students to develop intellectual independence, critical thinking skills and versatility.

3. Principles of various conventional and specialized laboratory investigations and instrumentation, analysis and interpretation of a given data; the ability to suggest experiments to support theoretical concepts and clinical diagnosis.

4. Molecular mechanisms of gene expression and regulation, the principles of genetic engineering and their application in medicine, agriculture, environment and food industries.

5. Biochemical and microbial basis of environmental health hazards and their remedial process and detoxication of xenobiotics

6. Inherited &disorders related to metabolism, microorganism, their pathology and possible cure

7. Molecular concepts of body defence and their application in medicine.

8 Infective micro-organisms of the human body and parasite interaction.

9. To acquire knowledge of antimicrobial agents for treatment of infection, scope of

Immunotherapy and different vaccines available for prevention of communicable diseases

10. To be acquainted with methods of disinfection and sterilization to control and prevent hospital and community acquired infections

11. To conserve, map and sustainably use bioresources.

12. To disseminate general awareness for the optimum utilization of biotechnology in various sectors.

13. To optimally focus resources for R&D in biosciences.

14. To create centers of excellence as high quality support services to biotech industries.

15. To promote the field of bioinformatics.

16. To suitably address highly pertinent issues like intellectual property rights (IPR) protection, biosafety and bioethics.

**2. Role of curriculum in national development**

Bioscience has an important role to play in future social and economic well-being, on a national and international scale. It can lead to major following benefits:

1. Advances in agriculture and crop technology can help fight world starving population.

2. Innovations in food and nutritional science can lead to everyday improvements in health and hygiene.

3. Innovative technology can boost the leading role of Indian commerce specially food & dairy, pharmaceutical, agriculture and FMCG.

4. Producing things using biotechnology and contributing towards national economy and GDP

5. Designing new drugs with the help of r DNA technology for curing diseases.

6. Finding cure for various genetic disorders and adding health benefits to Indian society.

**3. Global trends reflecting in the curriculum**

The profession of scientist has pious mandatory duty to undertake research and develop new products using micro organisms, stem cell, restriction enzymes, genome etc. in various field of bioscience which attribute to human welfare ,directly or indirectly . The current science is rapidly advancing by the efforts of the biochemist, biotechnologist and microbiologist. Present course have been developed to educate the student not only about the advancement in the field of biosciences but also to give them exposure of these requisites.

**4. Possibility, motivation and scope for self learning**

Knowledge of Biosciences helps identity various areas where the application of r-DNA technology, genetic engineering, biochemical and microbiological technique could be utilized. The products like new drugs, vaccines, GMF, transgenic animal, transgenic plant, diseases diagnostic kits, biopesticides etc. could be generated in the benefit of mankind and society. This field need good level scientific input from scientists trained across various disciplines including analytical biochemistry, clinical biochemistry, molecular biology, genetic engineering, Nano-technology , bioprocess technology, microbiology etc.

**5. Placement opportunities**

A wide range of career opportunities are available for students of Bioscience. There are numerous opening available to choose from one they have attained education. Those include:

Agriculture, Agrochemical Companies, Clinical and Forensic Science Laboratories, Corporate Firms, Food /Beverages Industries, Hospitals, Pharmaceutical Industry, Research and Educational Institutions, Clinical Research, Management, Manufacturing, Marketing, Quality Control, Information Science ,Technical Writing and Editing. Besides this students can also opt for teaching in the respective field.

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**SCHOOL OF SCIENCES**

**Teaching and Examination Scheme for M.Sc Biochemistry (Regular) 2Year Course**

**EFFECTIVE FROM ACADEMIC SESSION 2015-16**

**Year: I Semester: I**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 509 | Soft Skills-I | 3 | 3 |  |  | 3 | 40 | 60 |
| 2. | PCA-101 | Proficiency in Co-Curricular Activity | 2 |  |  |  |  | 100 |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 501 | Cell Biology | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 503 | Immunology and Virology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 505 | Biochemical Techniques | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 507 | Molecular Biology and Genetics | 3 | 3 |  | - | 3 | 40 | 60 |
|  |  |  |  |  |  |  |  |  |  |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 551 | Cell Biology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 553 | Immunology and Virology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 555 | Biochemical Techniques Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 557 | Molecular Biology and Genetics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 501 | Seminar - I | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **26** | **15** | **2** | **12** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |

**Year: I Semester: II**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | **(A)University Core:** |  |  |  |  |  |  |  |  |
| 1 | HS 516 | Soft Skills-II | 3 | 3 |  |  | 3 | 40 | 60 |
| 2. | PCA-102 | Proficiency in Co-Curricular Activity | 2 |  |  |  |  | 100 |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 502 | Chemistry of Biomolecules | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 504 | Enzyme Technology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 506 | Biochemistry of Hormones and Vitamins | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 508 | Genetic Engineering | 3 | 3 |  | - | 3 | 40 | 60 |
|  | **Program Core:Practicals** |  |  |  |  |  |  |  |  |
| 7 | SC 552 | Chemistry of Biomolecules Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 554 | Enzyme Technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 556 | Biochemistry of Hormones and Vitamins Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 558 | Genetic Engineering Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 502 | Seminar - II | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **26** | **15** | **2** | **12** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |

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**SCHOOL OF SCIENCES**

**Teaching and Examination Scheme for M. Sc Biochemistry (Regular) 2Year Course**

**EFFECTIVE FROM ACADEMIC SESSION 2015-16**

**Year: II Semester: III**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 623 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-103 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 601 | Plant Biochemistry and Biotechnology | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 603 | Biostatistics and Bioinformatics | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 605 | Microbial Biochemistry | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 611 | Advanced Clinical Biochemistry | 3 | 3 |  | - | 3 | 40 | 60 |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 559 | Plant Biochemistry and Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 561 | Biostatistics and Bioinformatics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 563 | Microbial Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 565 | Advanced Clinical Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 601 | Seminar – III | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
| 12 | **SC 617** | Animal Biotechnology | 3 | 3 |  |  |  | 40 | 60 |
| 13 | **SC 657** | Animal Biotechnology Lab | 2 |  |  | 3 |  | 60 | 40 |
| 14 | **SC 619** | Food Technology | 3 | 3 |  |  |  | 40 | 60 |
| 15 | **SC 663** | Food Technology lab | 2 |  |  | 3 |  | 60 | 40 |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **31** | **18** | **2** | **15** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **33** |  |  |  |  |  |

**Year: II Semester: IV**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **A. Practical & Sessional:** |  |  |  |  |  |  |  |
| 1 | DI 602 | Dissertation/ Project work | 20 |  |  | - | 2 |  | 100 |
|  |  | **Total** | **20** |  |  |  | **-** | **-** | **-** |
|  |  | **Total Teaching Load** |  |  |  |  |  |  |  |

Note:-Practical exercises will be based on theory papers taught in the respective semester

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**SCHOOL OF SCIENCES**

**Teaching and Examination Scheme for M.Sc Biotechnology (Regular) 2Year Course**

**EFFECTIVE FROM ACADEMIC SESSION 2013-14**

**Year: I Semester: I**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 509 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-101 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 501 | Cell Biology | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 503 | Immunology and Virology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 505 | Biochemical Techniques | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 507 | Molecular Biology and Genetics | 3 | 3 |  | - | 3 | 40 | 60 |
|  |  |  |  |  |  |  |  |  |  |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 551 | Cell Biology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 553 | Immunology and Virology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 555 | Biochemical Techniques Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 557 | Molecular Biology and Genetics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 501 | Seminar - I | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **26** | **15** | **2** | **12** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |

**Year: I Semester: II**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 516 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-102 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 508 | Genetic Engineering | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 510 | Environmental Biotechnology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 512 | Biochemistry | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 514 | Microbial Diversity and Physiology | 3 | 3 |  | - | 3 | 40 | 60 |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 652 | Genetic Engineering Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 654 | Environmental Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 656 | Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 658 | Microbial Diversity and Physiology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 502 | Seminar - II | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **26** | **15** | **2** | **12** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |

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**SCHOOL OF SCIENCES**

**Teaching and Examination Scheme for M.Sc Biotechnology (Regular) 2Year Course**

**EFFECTIVE FROM ACADEMIC SESSION 2015-16**

**Year: II Semester: III**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 623 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-103 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 603 | Biostatistics and Bioinformatics | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 607 | Plant Biotechnology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 621 | Bioprocess Technology | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 617 | Animal Biotechnology | 3 | 3 |  | - | 3 | 40 | 60 |
|  |  |  |  |  |  |  |  |  |  |
|  | **Program Core:Practicals** |  |  |  |  |  |  |  |  |
| 7 | SC561 | Biostatistics and Bioinformatics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC653 | Plant Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC655 | Bioprocess Technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC657 | Animal Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 601 | Seminar – III | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
| 12 | **SC 619** | Food Technology | 3 | 3 |  |  |  | 40 | 60 |
| 13 | **SC 663** | Food Technology lab | 2 |  |  | 3 |  | 60 | 40 |
| 14 | **SC 667** | Stem Cell Technology | 3 | 3 |  |  |  | 40 | 60 |
| 15 | **SC 671** | Stem Cell Technology lab | 2 |  |  | 3 |  | 60 | 40 |
|  |  | **Total** | **31** | **18** | **2** | **15** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **33** |  |  |  |  |  |

**Year: II Semester: IV**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 1 | DI 602 | Dissertation/ Project work | 20 |  |  |  | 2 |  | 100 |
|  |  | **Total** | **20** |  |  |  | **-** | **-** | **-** |
|  |  | **Total Teaching Load** |  |  |  |  |  |  |  |

Note:-Practical exercises will be based on theory papers taught in the respective semester

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**SCHOOL OF SCIENCES**

**Teaching and Examination Scheme for M. Sc Microbiology (Regular) 2Year Course**

**EFFECTIVE FROM ACADEMIC SESSION 2015-16**

**Year: I Semester: I**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 509 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-101 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 501 | Cell Biology | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 503 | Immunology and Virology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 505 | Biochemical Techniques | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 507 | Molecular Biology and Genetics | 3 | 3 |  | - | 3 | 40 | 60 |
|  |  |  |  |  |  |  |  |  |  |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 551 | Cell Biology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 553 | Immunology and Virology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 555 | Biochemical Techniques Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 557 | Molecular Biology and Genetics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 501 | Seminar – I | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **26** | **15** | **2** | **12** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |

**Year: I Semester: II**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 516 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-102 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 508 | Genetic Engineering | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 510 | Environmental Biotechnology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 512 | Biochemistry | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 514 | Microbial Diversity and Physiology | 3 | 3 |  | - | 3 | 40 | 60 |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 652 | Genetic Engineering Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC 654 | Environmental Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC 656 | Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC 658 | Microbial Diversity and Physiology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 502 | Seminar – II | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **26** | **15** | **2** | **12** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **29** |  |  |  |  |  |

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**SCHOOL OF SCIENCES**

**Teaching and Examination Scheme for M.Sc Microbiology (Regular) 2Year Course**

**EFFECTIVE FROM ACADEMIC SESSION 2015-16**

**Year: II Semester: III**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  | 1. **University Core:** |  |  |  |  |  |  |  |  |
| **1.** | HS 623 | Soft Skills-I | **3** | **3** |  |  | **3** | 40 | 60 |
| 2. | PCA-103 | Proficiency in Co-Curricular Activity | **2** |  |  |  |  | **100** |  |
|  | **(B) Program Core: Theory** |  |  |  |  |  |  |  |  |
| 3 | SC 603 | Biostatistics and Bioinformatics | 3 | 3 |  | - | 3 | 40 | 60 |
| 4 | SC 609 | Medical Microbiology | 3 | 3 |  | - | 3 | 40 | 60 |
| 5 | SC 613 | Fermentation Technology | 3 | 3 |  | - | 3 | 40 | 60 |
| 6 | SC 619 | Food Technology | 3 | 3 |  | - | 3 | 40 | 60 |
|  |  |  |  |  |  |  |  |  |  |
|  | **Program Core:Practicals** | **:** |  |  |  |  |  |  |  |
| 7 | SC 655 | Biostatistics and Bioinformatics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 8 | SC659 | Medical Microbiology lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 9 | SC661 | Fermentation Technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 10 | SC663 | Food Technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| 11 | SM 601 | Seminar – III | 1 |  | 2 |  |  | 100 | - |
|  | **(C)Program Elective:** |  |  |  |  |  |  |  |  |
| 12 | **SC 607** | Plant Biotechnology | 3 | 3 |  |  |  | 40 | 60 |
| 13 | **SC 653** | Plant Biotechnology Lab | 2 |  |  | 3 |  | 60 | 40 |
| 14 | **SC 617** | Animal Biotechnology | 3 | 3 |  |  |  | 40 | 60 |
| 15 | **SC 657** | Animal Biotechnology Lab | 2 |  |  | 3 |  | 60 | 40 |
|  | **(D)Open Elective:** |  |  |  |  |  |  |  |  |
|  |  | **Total** | **31** | **18** | **2** | **15** |  | **-** | **-** |
|  |  | **Total Teaching Load** |  | **33** |  |  |  |  |  |

**Year: II Semester: IV**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
|  |  | **B. Practical & Sessional:** |  |  |  |  |  |  |  |
| 1 | DI 602 | Dissertation/ Project work | 20 |  |  | - | 2 |  | 100 |
|  |  | **Total** | **20** |  |  |  | **-** | **-** | **-** |
|  |  | **Total Teaching Load** |  |  |  |  |  |  |  |

Note:-Practical exercises will be based on theory papers taught in the respective semester

**GYAN VIHAR SCHOOL OF SCIENCES**

**LIST OF COURSES OFFERED**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Credits** | **Contact Hrs/Wk.** | | | **Exam Hrs.** | **Weightage (in%)** | |
| **L** | **T/S** | **P** | **CE** | **ESE** |
| SC 501 | Cell Biology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 502 | Chemistry of Bio-molecules | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 503 | Immunology and Virology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 504 | Enzyme Technology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 505 | Biochemical Techniques | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 506 | Biochemistry of Hormones and Vitamins | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 507 | Molecular Biology and Genetics | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 508 | Genetic Engineering | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 510 | Environmental Biotechnology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 512 | Biochemistry | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 514 | Microbial Diversity and Physiology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC551 | Cell Biology Lab | 2 | **-** | - | 3 | 8 | 60 | 40 |
| SC552 | Chemistry of Bio-molecules Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC553 | Immunology and Virology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC554 | Enzyme Technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC555 | Biochemical Techniques Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC556 | Biochemistry of Hormones and Vitamins Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC557 | Molecular Biology and Genetics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC558 | Genetic Engineering Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC654 | Environmental Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC656 | Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC658 | Microbial Diversity and Physiology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC 601 | Plant Biochemistry and Biotechnology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 603 | Biostatistics and Bioinformatics | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 605 | Microbial Biochemistry | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 607 | Plant Biotechnology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 609 | Medical Microbiology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 611 | Advanced Clinical Biochemistry | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 613 | Fermentation Technology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 617 | Animal Biotechnology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 619 | Food Microbiology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC 621 | Bioprocess technology | 3 | 3 | - | - | 3 | 40 | 60 |
| SC559 | Plant Biochemistry and Biotechnology Lab | 2 | - | - | 3 | 4 | 60 | 40 |
| SC561 | Biostatistics and Bioinformatics Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC563 | Microbial Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC653 | Plant Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC659 | Medical Microbiology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC565 | Advanced Clinical Biochemistry Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC661 | Fermentation Technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC657 | Animal Biotechnology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC663 | Food Microbiology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC655 | Bioprocess technology Lab | 2 |  |  | 3 | 4 | 60 | 40 |
| SC 667 | Stem Cell Technology | 3 | 3 |  |  |  | 40 | 60 |
| SC 671 | Stem Cell Technology lab | 2 |  |  | 3 |  | 60 | 40 |
| SM 501 | Seminar – I | 1 | - | 2 | - | - | 100 | - |
| SM 502 | Seminar – II | 1 | - | 2 | - | - | 100 | - |
| SM 601 | Seminar – III | 1 | - | 2 | - | - | 100 | - |
| **HS 509** | **Soft Skills-I** | **3** | **3** |  |  | **3** | **30** | **70** |
| **HS 516** | **Soft Skills-II** | **3** | **3** |  |  | **3** | **30** | **70** |
| **HS 623** | **Soft Skills-III** | **3** | **3** |  |  | **3** | **30** | **70** |
| PCA101 | PCA -101 | **2** |  |  |  |  | **100** |  |
| PCA102 | PCA-102 | **2** |  |  |  |  | **100** |  |
| PCA103 | PCA-103 | **2** |  |  |  |  | **100** |  |
| DI 602 | Dissertation/ Project work | 20 | - | - | - | 2 | - | 100Semester |

**L = Lecture T = Tutorial CE = Continuous Evaluation**

**S = Seminar P = Practical ESE = End Semester Examination**

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| --- | --- | --- | --- |
| **SC 501** | | **CELL BIOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Plasma membrane** | |
| Plasma membrane: Ultrastructure of cell, cell theory, exceptions of cell theory. Membrane bilayer - Composition and structure: Models, fluidity, Liposomes. Membrane associated receptors. Membrane proteins – types, Flippases, protein of RBC membrane, RBC ghost, porins and aquaporin. and membrane transport system. | | | |
| **Unit- II** | | **Cell organelles and secretion** | |
| Cell organelles and secretion: Golgi, endoplasmic reticulum, lysosomes, peroxisomes. Internalization of macromolecules and particles: endo and exocytosis. Mitochondrial structure and oxidative phosphorylation. Chloloplast and Photo phosphorylation.  Nucleus : Nuclear envelope, nucleolus, chromosomes and their structural organization, Ribosomes | | | |
| **Unit-III** | **Cell division and cell cycle** | | |
| Cell division and cell cycle: Cell cycle and its regulation, regulation of cell division Go-G1 transition check points in cell cycle, chromosome movements. Mutation and its types, molecular basis of mutation. Cytoskeleton . topography, microtubules, microfilaments | | | |
| **Unit-IV** | | | **Signal transduction** |
| Signal transduction: Cell Cell signaling, Signal Transduction cascades. Receptor triggerd phosphorylation cascade, G protein, G protein coupled receptor, functions of cell surface receptor, pathways of intracellular signal transduction. Cascade, cyclic CAMP as a second messenger, Protein kinases, receptor mediated hydrolysis of phosphotidyl inositol, IP3, Diacyl glycerol. | | | |
| **Unit-V** | | | **Cancer** |
| Cancer : Properties of tumor cells, tumor suppressor genes and carcinogenic effects of chemical and radiations . Apoptosis, difference between necrosis and apoptosis, pathways, regulation and effectors in apoptosis. Cell cell interaction,cell – cell adhesion, specialized junction, desmosomes, gap junction, adhesion molecules, cadherins and connexins | | | |
| **Reference books** | | | 1. Molecular Cell biology, Lodish, Berk and others. W.H. Freeman and Co., 2004, Fifth Edition. 2. Principles of Biochemistry, Garrette and Grisham, Saunders College Publishing, 1994. 3. Molecular Cell Biology, Harvey Lodish, Baltimore David *et al*., Scientific American Books, W.H.Freeman and Company, Third Edition, 1995. 4. Bohinski, R.C.: Modern concepts in Biochemistry (Alllyn & Bascon Inc. Boston) 5. Caret et al.(1993): Inorganic, Organic and Biological Chemistry (WMC Brown Publ. USA). 6. West,E.S. and Todd, W.R.,Mason H.S.,and Bruggen J.T. (1963):Text Book of Biochemistry(Macmilan Co. London. 7. Lehninger,A.H. et al (1993) : Principles of Biochemistry (Worth Publ. Inc. USA). 8. Montgomery, R. et al (1990): Biochemistry: A case Oriented Approach (The C.V. Mosby Co., St. Louis). 9. Rawn, J.D. (1989) : Biochemistry (Neil Patterson Publ. North Carolina). |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 502** | | **CHEMISTRY OF BIOMOLECULES** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | |  | |
| **Carbohydrate: -**Chemistry and classification of carbohydrates. Structure and physiochemical Properties of Monosaccharides,Disaccharides,Polysaccharides,proteoglycans,and glycoproteins. **Metabolism of carbohydrates**- Glycolysis, Citric Acid cycle, Pentose phosphate pathway, , gluconeogenesis, glyoxylate cycle, glycogenesis and glycogenolysis. Regulation of glycolysis and gluconeogenesis. | | | |
| **Unit- II** | |  | |
| **Lipids:-**Chemistry and Classification of lipids. Fatty acids-structure, types and their physiochemical propertie. Structure and biological role of TAG, phospholipids, sphingolipids, Gangliolipids and cholesterol. Bile acids and bile salts. Structure and biological role of lipoproteins, prostaglandins,  **Metabolism of lipids**: Biosynthesis and Regulation of fatty acids , triacylglycerols., phospholipids sphingolipids prostaglandins, and their biological functions. Biosynthesis of cholesterol, its regulation . alpha, beta and gamma oxidation of fatty acids. Formation of ketone bodies. | | | |
| **Unit-III** |  | | |
| **Protein :-**Chemistry and Physiochemical properties of the amino acids, peptide bond ,Peptides &Peptide Synthesis – Solution and solid phase methods Proteins structure- primary, Secondary structure – Alpha Helix, Beeta Sheet, 310, Pie helix, Super secondary structure. Ramchandran plot. Tertiary and quaternary structure. Effect of temperature, salts, acids and alkali solution on protein structure. .Protein sequencing ,determination of the N and C terminal residues of a protein, Introduction to DNA- protein interaction . | | | |
| **Unit-IV** | | |  |
| **Protein metabolism –** General reactions of amino acid metabolism - Transamination, decarboxylation, oxidative & non-oxidative deamination of amino acids. . Urea cycle and its regulation. Biosynthesis of amino acids: precursor families of amino acids biosynthesis Biosynthesis of aromatic amino acids, Histidine, Peptides synthesis, protein metabolism in prolonged fasting.  **Porphyrins –** Biosynthesis and degradation of porphyrins. Production of bile pigments | | | |
| **Unit-V** | | |  |
| **Nucleic acid: -** Chemistry of Nucleic acids. Structure and composition of nucleic acids. Types of DNA (B, A, C and Z forms). Forces stabilizing nucleic acid structure. DNA bending –wedge and junction model, super coiled forms of DNA. Effect of temperature, salts, acid, alkali and enzymes on nucleic acid structure. Cruciform structure and its stability. Types of RNA- Secondary and tertiary structure. Nucleoproteins. DNA – Protein interaction. Fractionation and analysis of nucleic acids. Solution methods, chromatography, electrophoresis, centrifugation, blotting techniques and auto radiographic methods.  **Metabolism of nucleotides**– Biosynthesis and degradation of purine and pyrimidine nucleotides and its regulation (De-novo & salvage pathway.) inhibitors of nucleic acid biosynthesis. Disorders in purine and pyrimidine metabolism | | | |
| **Reference books** | | | 1. Lehninger,A.H. et al (1993) : Principles of Biochemistry (Worth Publ. Inc. USA) 2. Montgomery, R. et al (1990) : Biochemistry: A case Orientede Approach (The C.V. Mosby Co.,St. Louis) 3. Practical Biochemistry by Plummer. 4. Practical Biochemistry by Sawhney and R. Singh 5. Protein Biotechnology, Gary Walsh and Denis Headon, John Wiley and Sons, 1994. 6. Proteins Biochemistry and Biotechnology, Gary Walsh, John Wiley & Sons Ltd. 2002 |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 503** | | **IMMUNOLOGY AND VIROLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **History and scope of immunology** | |
| History and scope of immunology - types of immunity - anatomy of lymphoid organs; primary and secondary lymphoid organs - immunoglobulin structure -Function and synthesis; memory cells, idiotypic network, lymphocyte differentiation. Cells of the immune system. | | | |
| **Unit- II** | | **Antigens and Antibodies** | |
| Antigens and Antibodies, Antigen - isolation, purification and characterization of various antigens and haptens -antibodies - production, purification and quantification of immunoglobulin’s; antigen -antibody reaction; hybridoma and monoclonal antibody production; immuno-diagnosis and applications - human monoclonal antibodies; catalytical antibodies -complement fixation - assessment of immune complexes in tissues.Biology and assay of cytokines .Vaccine technology including DNA vaccines | | | |
| **Unit-III** | **Biology of complement systems** | | |
| Biology of complement systems- structure and function of MHC class I and II molecules - antigen recognition and presentation - humoral and Cell mediated immune responses - hypersensitivity reaction - immune suppression and immunetolerance - auto immune disorders  Immunological techniques and their principles. | | | |
| **Unit-IV** | | | **General Virologyand Introduction of Viruses** |
| General Virologyand Introduction of Viruses: Brief outline on discovery of viruses, nomenclature and classification of viruses : distinctive properties of viruses; morphology & ultra structure; capsid & their arrangements; types of envelope and their composition-viral genome, their types and structures; virus related agents (Viroids, Prions)  Viral vaccines (conventional vaccines, genetic recombinant vaccines used in national immunisation programmes with examples, new generation vaccines including DNA Vaccines with examples) Interferons and antiviral drugs. | | | |
| **Unit-V** | | | **General methods of Diagnosis** |
| General methods of Diagnosis: Cultivation of viruses in embryonated eggs, experimental animals , cell cultures, Primary & secondary cell cultures, suspension cell cultures and monolayer cell cultures, cell strains, cell lines and transgenic systems; assay of viruses physical and chemical methods (Protein, nucleic acid, radioactivity tracers, electron microscopy)-Infectivity assay ( plaque method, end point method)- Infectivity of plant viruses | | | |
| **Reference books** | | | 1. Kuby Immunology,4th Edition-R.A. Goldsby,Thomas J.Kindr.Barbara,A.Osbarne,(Freeman) & Co.New York.   Immunology-A short course,4th Edition-Eli Benjamini,Richard Coico,Geoffrey Sunshine,(Wiley-Liss).   1. Roitt,I.M.(1998) Essentials of Immunology,ELBS,Blackwell Scientific publishers,London.   Immunology byA. K. Abbas.   1. Morag C and Timbury M.C.(1994) Medical virology-X Edition. Churchill Livingstone,London. 2. Dimmock Nj,Primrose SB(1994).Introduction to Modern Virology,IV Edition,Blackwell Scientific Publications,Oxford. 3. Conrat HF,Kimball PC and Levy JA(1994)virology-III Edition Prentice Hall,Englewood cliff,New jersey. 4. Matews,RE.,(1992)Functionals of plant virology,Academic press,San Diego. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 504** | | **ENZYME TECHNOLOGY** | | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | | |
| **Unit-I** | | **Enzyme** | | |
| Enzyme: Historical aspects, classification and nomenclature, EC number. Mechanism of enzyme action-Acid base catalysis,covalent catalysis.proximity, orientation effect. Strain &distortion theory. Sub cellular localization and organization of enzymes. Methods of enzyme assay: turnover number; specific activity , Active site. | | | | |
| **Unit- II** | | **Enzyme Kinetics** | | |
| Enzyme Kinetics: Concept of ES complex, activation energy **,**Derivation of Michaelis-Menten equation. Different plots for the determination of Km and Vmax. and their significances. Affecting factors of rate of enzyme reaction .Classification of multi substrate reaction, ping-ping, random &ordered Bi-Bi mechanism.Enzyme inhibition: reversible and irreversible inhibition, their type, inhibitor constant and its significance. | | | | |
| **Unit-III** | **Enzyme Regulation** | | | |
| Enzyme Regulation - General mechanisms of enzyme regulation, product inhibition. Reversible and irreversible . covalent modifications of enzymes. Feed back inhibition Allosteric enzymes, qualitative description of “concerted” & “sequential” models for allosteric enzymes. Half site reactivity, positive and negative co-operativity with special reference to aspartate transcarbamoylase & phosphofructokinase. Protein-ligand binding ,Hill and Scatchard plots. Metallo-enzymes | | | | |
| **Unit-IV** | | | **Enzyme purification techniques:** | |
| Enzyme purification techniques: objectives and strategy; methods of homogenization; method of isolation; purification and crystallization Criteria of purity and tabulation of purification data; stable storage of enzymes Characterization of purified enzyme. Coenzymes, Cofactors and Isoenzymes | | | | |
| **Unit-V** | | | **Enzyme immobilization** | |
| Enzyme immobilization; Immobilization of Enzymes by chemical and physical methods. Large scale production of enzymes, Enzyme reactors,. Application of Immobilized Enzymes .Enzymes in Medical diagnosis and enzyme therapy. Biosensors. | | | | |
| **Reference books** | | | | 1. Enzyme Assays: A Practical Approach by Eisenthal and Danson 2. Enzyme Biotechnology by G. Tripathi 3. Enzyme Catalysis and Regulation by Hammes 4. Enzyme Reaction Mechanisms by Walsch 5. Enzyme Structure and Mechanism by Alan Fersht 6. Enzyme technology, M.F.Chapline and C.Buke, Cambridge University Press, First Edition, 1990. 7. Fundamentals of Enzymology, Nicholas C.Price and Lewis Stevens, Oxford Univ. Press, Third Edition, 1999. |
| **Mode of Examination** | | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | | |  |
| **Approved by academic council on:** | | | |  |

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| **SC 505** | | **BIOCHEMICAL TECHNIQUES** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Electrophoretic techniques** | |
| Electrophoretic techniques : Principle, types and affecting factors. Instrumentation and application of paper, gel, SDS- PAGE, Isoelectric focusing, 2-DGel electrophoresis, Pulsed field gel electrophoresis and capillary electrophoresis. Membrane filtration and dialysis | | | |
| **Unit- II** | | **Centrifugation techniques** | |
| Centrifugation techniques: Principle and technique of preparative and analytical centrifugation, Differential centrifugation, Density gradient centrifugation, ultracentrifuge and its application .Introduction to Tracer techniques. | | | |
| **Unit-III** | **Chromatographic Techniques** | | |
| Chromatographic Techniques– Principle, technique and applications of Paper, TLC, Ion-Exchange, molecular sieve, affinity chromatography and adsorption chromatography,. Gas chromatography, HPLC | | | |
| **Unit-IV** | | | **Spectroscopic technique** |
| Spectroscopic technique– Basic principles, instrumentation and applications of UV, Visible , spectroflourimetry and IR spectrophotometers. Optical Rotatory Dichroism and Circular Dichroism. Nuclear Magnetic Resonance ESR, X-Ray Crystallography and Mass Spectrometry. Flame Photometry. | | | |
| **Unit-V** | | | **Radio chemical methods** |
| Radio chemical methods - Nature of radioactivity, types of radioactivity, radioactive decay, units of radioactivity. Radioisotopes: Detection and measurement of radioactivity. Geiger counters, scintillation counters, autoradiography. Microscopy: light, phase-contrast, fluorescence and electron microscopy. | | | |
| **Reference books** | | | 1. Analytical Biochemistry, D.J.Homie and Hazal Peck, Longman group,3rd edition, 1998. 2. Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H.Freeman and Co., Third Edition, 1999. 3. Physical Biochemistry - Application of Biochemistry and Molecular Biology, David Friefelder, W.H.Freeman and Co., Second Edition, 1999. 4. Principles of Instrumental Analysis, Skoog/Leary, Saunders College Publishing, Fourth Edition, 1992. 5. Principles of Physical Biochemistry, Kensal E.Van Holde, W.Curtis Johnson, Harcourt Brace College Publishers, 1998 |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 506** | | **BIOCHEMISTRY OF HORMONES & VITAMINES** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to endocrine gland** | |
| Introduction to endocrine gland. Hormone classification on the basis of chemical nature and mechanism. Mechanism of hormone action, hormone receptors, role of second messengers, hormone and homeostasis, local hormones and feedback regulation of hormone. | | | |
| **Unit- II** | | **Pituitary gland** | |
| Pituitary gland –Endocrine hypothalamus- secretion and physiological roles of hypothalamic releasing and inhibitory factors. Biosynthesis, mechanism of action, physiological roles and regulation of anterior and posterior pituitary hormones. Pituitary endocrinal disorders. Pineal gland –synthesis, mechanism of action and functions of melatonin. | | | |
| **Unit-III** | **Thyroid gland** | | |
| Thyroid gland – Biosynthesis, mechanism of action, regulation and physiological role of thyroid hormones. Hypothyroidism and hyper thyroidism. Parathyroid gland –biosynthesis, regulation and physiological role of parathyroid hormones. Hormonal regulation of calcium metabolism. Endocrine pancreas –Chemistry, mechanism of action and physiological roles of insulin, glucagon, somatostatin and pancreatic peptide. Hormones of Gastrointestinal tract. | | | |
| **Unit-IV** | | | **Adrenal gland** |
| Adrenal gland- Biosynthesis, mechanism of action, regulation and physiological roles of adrenal hormones. Adrenal hormones disorders.Reproductive Endocrinology – Male sex hormones –synthesis, mechanism of action, regulation and physiological roles of androgens. Female sex hormones –Biosynthesis, mechanism of action, physiological roles and regulation of ovarian hormones. Placental hormones, hormonal regulation of pregnancy, menstrual cycle and lactation. | | | |
| **Unit-V** | | | **Vitamins** |
| Vitamins: Classification. Structure and physiological role of fat and water soluble vitamins. Vitamins related metabolic Disorders. | | | |
| **Reference books** | | | 1.[Clinical Endocrinology 2012 (The Clinical Medicine Series)](http://www.amazon.com/Clinical-Endocrinology-Medicine-Series-ebook/dp/B004I5BU9S/ref=sr_1_1?s=books&ie=UTF8&qid=1334997523&sr=1-1) by M.D., C. G. Weber2.[Harrison's Endocrinology, Second Edition](http://www.amazon.com/Harrisons-Endocrinology-Second-Edition-Jameson/dp/0071741445/ref=sr_1_4?s=books&ie=UTF8&qid=1334997523&sr=1-4) by J. Jameson (May 18, 2010)3.[Basic Medical Endocrinology, Fourth Edition](http://www.amazon.com/Basic-Medical-Endocrinology-Fourth-Edition/dp/0123739756/ref=sr_1_6?s=books&ie=UTF8&qid=1334997523&sr=1-6) by [H. Maurice Goodman](http://www.amazon.com/H.-Maurice-Goodman/e/B001HCX7F0/ref=sr_ntt_srch_lnk_6?qid=1334997523&sr=1-6) (Sep 1, 2008)4.[Endocrinology (6th Edition)](http://www.amazon.com/Endocrinology-6th-Edition-Mac-Hadley/dp/0131876066/ref=sr_1_7?s=books&ie=UTF8&qid=1334997523&sr=1-7) by Mac Hadley and Jon E. Levine (Nov 3, 2006)5.Textbook of Medical Physiology, Guyton and Hall, Tenth Edition , Saunders Publishing Co.2000 6.Cynthia Gibas & Per Jambeck (2001) Developing Bioinformatics Computer Skills: -Shroff Publishers & Distributors Pvt. Ltd (O’Reilly), Mumbai |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
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| **SC 507** | | **MOLECULAR BIOLOGY AND GENETICS** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to Molecular Biology** | |
| Introduction to Molecular Biology, DNA Replication Mechanism (Prokaryotic and eukaryotic), Enzymes (Like DNA Polymerases, Topoisomerases etc) and accessory proteins involved in DNA replication. Inhibitors of DNA replication ( blocking precursor synthesis, nucleotide polymerization, altering DNA structure). Mutations: nature of mutations; mutagens . DNA damage and repair: types of DNA damage (deamination) oxidative damage, alkylation, pyrimidine dimers). Repair pathways-methyl-directed mismatch repair, very short patch repair, nucleotide excision repair, base excision repair, SOS system. | | | |
| **Unit- II** | | **Transcription** | |
| Transcription- Structural features of RNA (rRNA, tRNA and mRNA) .Prokaryotic transcription, Comparison with Eukaryotic transcription, Maturation and processing of RNA : methylation, cutting and trimming of rRNA; capping, polyadenylation and splicing of mRNA; cutting and modification of tRNA . Intron splicing | | | |
| **Unit-III** | **Translation** | | |
| Translation- Prokaryotic and eukaryotic translation mechanisms: Initation, Elongation and Termination. Post-translational modifications of proteins. Synthesis of Secretory and membrane proteins. | | | |
| **Unit-IV** | | | **Antisense and Ribozyme-Technology** |
| Antisense and Ribozyme-Technology, Applications of antisense and ribozyme technology. Gene transfer mechanisms in bacteria- transformation, transduction, conjugation. Plasmids, F type, R Type, and Col Type plasmids .Plasmids as vectors for gene cloning. Replication of plasmids and compatibility. | | | |
| **Unit-V** | | | **Regulation of bacterial gene expression** |
| Regulation of bacterial gene expression – Operon concept, catabolite repression, positive and negative regulation, inducers and corepressors, Operon model – lac, ara,and trp ; Antitermination – N protein and nut sites. Global regulatory responses : heat shock response, stringent response and regulation by small molecules such as ppGpp and cAMP. | | | |
| **Reference books** | | | 1. Freidberg, E.C., Walker, G.C., Siede, W. (2009). DNA repair and Mutagenesis, ASM Press, Washington D.C. 2. Lewin, B, (2011). Genes IX. Oxford University Press. 3. Malacinski, M. and Freifelder, D. (2010). Essential of Molecular Biology. III Edition. Jone and Barlett Publishers, Boston. 4. Maloy, S.R., Cronan, J.R. Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers. 5. Siger, M., Berg, P. (2005). Genes and Genomes, University Science Book. 6. Snustad, D., Simmons, J. and Jenkins, B. (2008). Principles of Genetics. First edition. JohnWiley and Sons. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 508** | | **GENETIC ENGINEERING** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Scope of Genetic Engineering** | |
| Scope of Genetic Engineering ,Milestones in Genetic Engineering - Core techniques (Blotting techniques, electrophoresis and Autoradiography) and essential enzymes used in rDNA technology-- Restriction enzymes, Ligases ,DNA polymerases Terminal transferase , ,Nucleic Acid Extraction , Purification, Yield Analysis. | | | |
| **Unit- II** | | **Cloning** | |
| Cloning -Principles of gene cloning, Types of cloning, Gene Cloning Vectors- Plasmids, Bacteriophages, Phasmids, Cosmids. Artificial chromosomes, Shuttle vectors. cDNA Synthesis and Cloning, Linkers and adaptors. | | | |
| **Unit-III** | **Genomic** | | |
| Library construction and screening -Genomic, Chromosomal, cDNA Library ,Screening of libraries  Analysis of DNA-Protein Interactions. Electro mobility shift assay, DNA Foot printing.. Primer extension method, SI mapping, RNase protection assays, Reporter genes and their assays. Microarray arrays Technology . | | | |
| **Unit-IV** | | | **PCR** |
| PCR, types and its applications. Site-directed Mutagenesis and Protein Engineering. Molecular Markers, DNA sequencing. | | | |
| **Unit-V** | | | **Recombinant protein Technology** |
| Recombinant protein Technology: Design and use of expression vectors, selection of suitable promoter sequences, ribosome binding sites, transcription terminator, plasmid copy number. Processing of Recombinant proteins- Stabilization of proteins. Phage Display, Inclusion Bodies, solubilization of insoluble proteins. Codon optimization, Fusion Proteins  Gene therapy, Gene silencing. | | | |
| **Reference books** | | | 1. Plant Biotechnology and transgenic plants, Caldentey. K. M. O,Marcel Dekker, 2002.  2. Molecular biotechnology: Principles and practices. Channarayappa University  press 2006.  3. From genes to clones.Winnacker. E. L. Panima Publishers, 2003  4. Principles of gene manipulation and Genomics. Primrose S. B. 7th edition  Blackwell Publishing 2006.  5. Genetic transformation of plants-Jackson JF,Linskens HF Vol.23,Springer,2003  6. Principles of cloning-Cibell.J Academic Press 2002  7. Molecular biotechnology: Principles and practices. Channarayappa. University press 2006.  8. Microbial biotechnology. Glazer. A.N. Freeman 1995  9. From genes to clones-Winnacker. E. L. Panima Publishers, 2003  10. Principles of gene manipulation and Genomics. Primrose S. B. 7th edition Blackwell Publishing 2006.  11. Recombinant Microbes for industrial and Agricultural application. Murooka Y. Marcel Decker.1. Molecular biotechnology: Principles and practices. Channarayappa University press 2006.  12. Microbial biotechnology. Glazer. A.N. Freeman 1995 |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **HS 509** | | **SOFT SKILLS-I** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Recap of English Language Skills** | |
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| **Unit- II** | | **Fluency Building** | |
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| **Unit-III** | **Principles of Communication** | | |
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| **Unit-IV** | | | **Types of Communication** |
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| **Unit-V** | | | **LSRW in Communication – Listening ,Speaking ,Reading & Writing** |
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| **Reference books** | | |  |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
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| **SC 510** | | **ENVIRONMENTAL BIOTECHNOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Environment** | |
| Environment-basic concepts and issues; Sources of water pollution .Natural resources and its management. Surface and underground source of water, Sources of water pollution. Waste water treatment, Process, stages methods: Aerobic Processes-Oxidation ponds, rotating discs, rotating drums; Anaerobic processes-Anaerobic digestion,anaerobic filters, Up flow anaerobic sludge blanket reactors. Pollution indicators – BOD and COD determinations, Water Quality standards impurities in water and their removal, Water purification.,Air pollution,air pollutents, particulate matter | | | |
| **Unit- II** | | **Xenobiotics** | |
| Microbial degradation of xenobiotics in Environment-Ecological hydrocarbons, oil pollution, surfactants, pesticides. Solid wastes :Sources and management. Types of solid wastes, sources, problems associated with it. solid waste management, landfilling, incineration, Vermi composting, vermiculture Vermi composting properties, and methane production. | | | |
| **Unit-III** | **Biodegradation** | | |
| Biodegradation and biodegradation of naturally occurring compounds.Biodegradation of cellulose, lignin, cellulose. Bioremediation concepts, types of bioremediation. In situ and Ex situ process of bioremediation. Renewal energy sources ,Non renewal energy sources ,Energy conservation. | | | |
| **Unit-IV** | | | **Biopesticides** |
| Biopesticides, plant, biochemical, microbial pesticides. Advantages and disadvantages of microbial pesticides and insecticides.Global environmental problems:UV-B and Ozone depletion, Green house effect and acid rain, their effects and biotechnological approaches for management. Methiodology of environmental management –the problem solving approach, its limitation. | | | |
| **Unit-V** | | | **Genetically modified organism** |
| Genetically modified organism, Uses of GMO and transgenic animal, Benefits and controversies of GM product. Classical plant breeding, molecular basis of genetic modification and crop improvement programmes, GM food crops, biotechnology in controlling crop diseases, weeds, insects and pests.  Seed-biology, technology and role in agriculture, Seed certification, seed banks, terminator gene technology and implications, plant as chemical and pharmaceutical factories, biosafety and GM food crops, Biogeochemical cycles :Oxygen cycle, Carbon cycle, Nitrogen cycle ,Phosphorus cycle ,Sulpher cycle. | | | |
| **Reference books** | | | Mackenzie L. Davis and Susan j.Mastens (2008)-Principles of Environmental Engineering and Science.  Gilbert M. Mastens and Wendell P. Ela. (2007) -Introduction of Envirnmental Engineering and Science .  Lawrance K.Wang (2010) -Enviromental biotechnology , publisher humana press Ist editionApril  Vyas R.K. et all (2008)-Basic Environmental Engineering, publisher Genius publication , Ist edition |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 512** | | **BIOCHEMISTRY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Carbohydrates** | |
| Carbohydrates:Classification of carbohydrates. Optical and chemical Properties of Monosaccharides. Occurrence, structure and biological functions of disaccharides and polysaccharides Metabolism of carbohydrate: Glycolysis,TCA cycle, HMP Pathway and gluconeogenesis . | | | |
| **Unit- II** | | **Lipids** | |
| Lipids: Classification of lipids. Fatty acids-structure, types and their physiochemical properties. Structure and biological role of TAG, phospholipids, sphingolipids, cholesterol. Structure and biological role of lipoproteins and prostaglandins. Metabolism of lipid: cholesterol biosynthesis,biosynthesis and oxidation of fatty acids. | | | |
| **Unit-III** | **Protein** | | |
| Protein: Amino acid structure, classification and Physiochemical properties of the amino acids. Stability and formation of the peptide bond. Proteins structure- primary, Secondary structure Ramchandran plot. Tertiary structure and quaternary structure. Protein sequencing. Metabolism: amino acid biosynthesis and urea cycle. | | | |
| **Unit-IV** | | | **Nucleic Acids** |
| Nucleic Acids: Composition and structure of nucleic acid . Types of DNA (B,A,C and Z forms). Forces stabilizing nucleic acid structure. Effect of temperature salts, acid, alkali and enzymes on nucleic acid structure. Types of RNA- Secondary and tertiary structure. Nucleoproteins . DNA – Protein interaction. Fractionation and analysis of nucleic acids. Metabolism of nucleic acid : Biosynthesis and degradation of purine and pyrimidine | | | |
| **Unit-V** | | | **Enzymes and bioenergetics** |
| Enzymes and bioenergetics :Basics of pH, acid –base and buffers .law of thermodynamics, Gibbs free energy and standard potential Enzymes: enzyme classification, nomenclature, specificity, active site, unit of activity. Enzyme kinetics: Michaelis – Menton equation, determination of kinetic parameters (Vmax,Km) enzyme inhibition, Enzyme catalysis, Enzyme regulation :feed back and allosteric regulation. Enzyme immobilization. | | | |
| **Reference books** | | | 1. Proteins, Structure and molecular properties, Thomas E.Creighton, W.H.Freeman, 1993.  2. DNA structure and function, Richard R.Sinden, Academic Press- 1994. DNA protein Interaction (Ed. Kiyoshi Nagai and I.W.Mattaj), Oxford University Press, 1996.  3. Proteins Biochemistry and Biotechnology, Gary Walsh, John Willey and Sons, Ltd. 2002.  4. Modern genetic analysis, Anthony J.Griffiths, Gelbart M.William, et al.,W.H.Freeman and Company, Second Edition, 2002.  5. Bioinformatics - A practical guide to the analysis of genes and proteins. (Ed.Baxevanis and Ouellette), Willey Inter Science, 1998.  6. Introduction to Bioinformatics, Dr.S.Sundara Rajan and R.Balaji, Himalaya Publishing House, First Edition, 2002.  7. Bioinformatics - Concepts, skills and applications. S.C.Rastogi, Namita, Mendiratta, Rastogi, CBS publishers, First Edition, 2003.  8. Visual Basic-6, Gary Cornell, Tata McGraw Hill publishing Company,Ltd., New Delhi,2002. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 514** | | **MICROBIAL DIVERSITY AND PHYSIOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Ultra structure and function of Bacteria** | |
| Ultra structure and function of Bacteria. Morphological types; cell wall characteristics,L-forms and Archaebacteria, Cell wall synthesis, capsule types,composition and function. Cell membranes in eubacteria, archabacteria and cyanobacteria. Structure and function of flagella, cilia and pili, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Plasmids and its types. Types of Reserve food materials . New approaches to bacterial taxonomy, classification including ribotyping; Ribosomal RNA sequencing; Characteristics of primary domains; Taxonomy, Nomenclature and Bergey's Manual**.** | | | |
| **Unit- II** | | **Cultivation of bacteria** | |
| Cultivation of bacteria, anaerobic, aerobic culture media, growth curve, growth kinetics, batch, continuous culture, growth measurements, factors affecting growth, control of bacteria-physical and chemical agents. Types of bacteria on the basis of energy and nutritional requirement. Pure culture techniques (spread plate, pour plate, streak plate), preservation methods  Nutritional classification of microorganisms- chemoautotrophs, chemoheterotrophs and photosynthetic microorganisms. Photosynthesis in microorganisms, oxygenic – anoxygenic photosynthesis – autotrophic generation of ATP; fixation of CO2 – Calvin cycle – C3 – C4 pathways | | | |
| **Unit-III** | **Chemolithotrophy** | | |
| Chemolithotrophy; Hydrogen, Iron, Nitrate and oxidizing bacteria; Nitrate and sulfate reduction; Syntrophy,Role of anoxic decomposition; Nitrogen metabolism; Nitrogen fixation; Hydrocarbon transformation. Survival at extreme environments – starvation – adaptative mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic. Bioluminescence - mechanism & advantages. | | | |
| **Unit-IV** | | | **Microbial respiration** |
| Microbial respiration and fermentative pathway**-** Respiratory metabolism –Enter Doudroff pathway – glyoxalate pathway,oxidative and substrate level phosphorylation –Fermentation of carbohydrates – homo and heterolactic fermentations. Endospore – structure – properties, germination and dormancy | | | |
| **Unit-V** | | | **Chemotherapy and Antimicrobial agents-** |
| Chemotherapy and Antimicrobial agents- Types of toxins(Exotoxin, Endotoxin and Enterotoxin) and their structure; mode of actions; virulence and pathogenesis.Chemotherapy and Antimicrobial agents; Sulfa drugs; Antibiotics; Penicillin and Cephalosporins; Broad-Spectrum antibiotics; Antibiotics from prokaryotes; Antifungal antibiotics; Mode of action; Resistance to antibiotics. General classification and Economic importance of algae and fungi. | | | |
| **Reference books** | | | 1. Caldwell, D.R. (1995). Microbial Physiology and metabolism, Wm. C. Brown Publishers, USA 2. Gottychalk, G. (1986). Bacterial Metabolism (Second Edition) Springer – Verlag, Bertin. Moat, A.G. and Foster, J.W. (1988). Microbial Physiology (Second Edition). John Wiley & Sons, New York. 3. Pelczar Jr, M.J. Chan, E.C.S. and Kreig, N.R. (1993). Microbiology, Mc. Graw Hill. Inc, New York. 4. White, D. (1995). The Physiology and biochemistry of Prokaryotes, Oxford University Press, Oxford, New York. 5. General Microbiology,Stainer, R.Y.Ingraham.J.L,Whelis,M.L and Painter,P.R. The Macmillan Press Btd. 6. Brock Biology Microorganism,Madigan,M.T.,Martinko J.M. and Parker,J.Printice-Hall. 7. Microbiology,Pelczar,M.J.Jr.,Chan,E.C.S. and Kreig,N.R.,Tata McGraw HIll. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
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| **SC667** | | **Stem Cell Technology** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to Stem cell biology** | |
| Introduction to Stem cell biology - What are stem cells (Properties, Existence), applications and current standings of the stem cell technology? | | | |
| **Unit- II** | | **Types of Stem Cells** | |
| Types of Stem Cells:Embryonic stem cells, Stem Cells from Adults. Pluripotency necessary, or is unipotency enough? What are the mechanisms? Stem-cell plasticity, Regulators of pluripotency and differentiation of stem cell. The isolation, expansion, genetic manipulation, genomic reprogramming, and cloning of stem cells. The problem of differentiation of stem cells. Stem Cells and imprinted genes. Differences between adult and embryonic stem cells, what types of cells adult stem cells can become. | | | |
| **Unit-III** | **Regenerative medicine** | | |
| Regenerative medicine: Current stem cell therapies, How we can use stem cells for studying cancer and finding cures to other diseases, Correlation between stem cells and cancer, Stem cells and aging. Clinical applications of hematopoietic stem cells from cord blood first successful transplantation of cord blood in a child with Fanconi’s anemia. Treatment of neural diseases such as Parkinson's disease, Huntington’s disease and Alzheimer's disease. Repair of damaged organs such as the liver and pancreas. | | | |
| **Unit-IV** | | | **Cloning and nuclear transfer Technology** |
| Cloning and nuclear transfer Technology: What is cloning? Human Therapeutic and Reproductive Cloning How can cloning technologies be used? Therapeutic Cloning: How it's Done, Therapeutic Cloning Can Cure Parkinson's-like Disease In mice, Human Cloning and Human Dignity: An Ethical Inquiry, Patient-Specific Embryonic Stem Cells Derived from Human SCNT Blastocyst. What animals have been cloned? Can organs be cloned for use in transplants? What are the risks of cloning? The Cloning of Dolly and other Mammals, viable offsprings derived from fetal and adult mammalian cells, Somatic Cell Nuclear Transfer: Why Clone Mammals? Is it safe to eat cloned livestock | | | |
| **Unit-V** | | | **Ethics** |
| Ethics: Controversy surrounding human embryonic stem cell research, societal implications: women, low-income, Different religious views, Current Ethical Guidelines in America, Ethical views of other countries and how this affects advancement of science Policy | | | |
| **Reference books** | | | 1. Ann A.Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Jones and Bartett, 2003.  2. Peter J.Quesenberry, Stem Cell Biology and Gene Therapy, 1st Edition, Willy-Less, 1998  3. Robert Lanja, Essential of Stem Cell Biology, 2nd Edition, academic Press, 2006.  4. A.D.Ho., R.Hoffiman, Stem cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.  5. C.S.Potten, stem Cells, Elsevier,2006 |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **HS 516** | | **SOFT SKILLS-II** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Thinking and Articulation** | |
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| **Unit- II** | | **Acquisition of Oral and Aural Skills** | |
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| **Unit-III** | **Communication Boosters** | | |
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| **Unit-IV** | | | **Function of Cultural Codes in Presentation** |
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| **Unit-V** | | | **Models of Presentation** |
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| **Reference books** | | |  |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
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| **SC 601** | | **PLANT BIOCHEMISTRY AND BIOTECHNOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to Plant tissue culture** | |
| Introduction to Plant tissue culture,.Totipotency; Cyto-differentiation. Initiation and maintenance of callus and suspension culture. Single cell culture. Organogenesis; Shoot-tip culture: rapid clonal propagation and production of virus-free plants. Transfer and establishment of whole plants in soil. | | | |
| **Unit- II** | | **Production of haploid plants** | |
| Production of haploid plants through anther and ovary culture. Somatic embryogenesis. Embryo culture and embryo rescue. Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids. Cryo-preservation, Germplasm conservation. | | | |
| **Unit-III** | **Gene transfer in plant** | | |
| Gene transfer in plant; Physical and Chemical methods. Agrobacterium and Ti plasmids, Binary vectors. Plant viruses as vectors. Transgenic plants - application, methods of engineering insecticide and herbicide resistant plants. Anti-sense RNA technology - altering nutritional contents of plant foods. | | | |
| **Unit-IV** | | | **Introduction to animal biotechnology** |
| Introduction to animal biotechnology. Equipments and required materials for animal cell culture technology. Characteristics of cells in culture; Growth and maintenance of cells in culture; Cells and Cell lines, Culture media: Natural and Chemical Defined Media; Advantages and Disadvantages of Serum and Protein based media. Isolation and Disaggregation of tissues by Mechanical and Enzymatic Methods. Primary and established cell line cultures. Monoclonal antibodies. Immuno toxins as therapeutic agents Stem cell culture, embryonic stem cells and their applications. | | | |
| **Unit-V** | | | **Overview of photosynthesis** |
| Overview of photosynthesis: Light reaction centre complex. The photosystem, Organization of thyllakoid. Electron transport pathways in chloroplast membranes. ATP synthesis in chloroplasts. Carbon reactions C3, C4 and CAM plants. Photorespiration. Nitrogen fixation - Enzymology of N2 fixation. Symbiotic and Non-symbiotic nitrogen fixation. Biochemistry of photo-periodism and seed dormancy. Biochemistry and physiological role of Plant hormone. | | | |
| **Reference books** | | | 1. Plant Biochemistry by Devlin. 2. Introduction of plant tissue culture : Rajdan and Bhojwani 3. Principles of gene manipuulation, Old,R.W. and Primrose,S.B., Blackwell Scientific Publishers, Fifth Edition, 1995. 4. .Plant Biochemistry and Molecular Biology – Hans, Walter and Heldt, Oxford UniversityPress,1997. 5. Plant Biotechnology –Adrian Slater, Nigel Scot and Mark Fowler,Oxford University Press,2003. 6. Animal Biotechnology-Frashney |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
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| **SC 603** | | **BIOSTATISTICS AND BIOINFORMATICS** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Definitions Scope of biostatistics** | |
| Definitions Scope of biostatistics, probability analysis – variables in biology, collection, classification and tabulation of data – graphical and diagrammatic representation – scale diagrams – historograms – frequency polygan – frequency curves. Measures of central tendency – arithmetic mean, median and mode – calculation of mean, median & mode in series of individual observations, discrete series continuous open – end classes. Measure of dispersion – standard deviation and standard curves. Measures of central tendency, Analysis of variance. | | | |
| **Unit- II** | | **Correlation and regression** | |
| Correlation and regression Simple correlation – correlation coefficient. Regression-simple, linear regression. Basic ideas of significance test – Hypothesis testing level of significance – Test based on student ‘t’ *‘chi’* square and goodness of fit. ‘F’ test - ANOVA. | | | |
| **Unit-III** | Bioinformatics and Databases | | |
| Bioinformatics and Databases. Introduction, aspects and role of Bioinformatics. Applications of Bioinformatics in Biology (Biocomputing). Biological resource databases – Examples and application – sequence Analysis –protein and nucleic acid. | | | |
| **Unit-IV** | | | Genomics and proteomics |
| Genomics and proteomics. Sequencing genomes – sequence assembly – genome on the web – annotating and analyzing genome sequences. proteomics – biochemical pathway databases. | | | |
| **Unit-V** | | | **Sequence analysis** |
| Sequence analysis. Pair wise sequence comparison. protein data bank, Swiss-prot, Genebank – sequence queries against biological databases – BLAST and FASTA – multifunctional tools for sequence analysis. multiple sequence alignments, phylogenetic alignment – profiles and motifs. | | | |
| **Reference books** | | | 1. Cynthia Gibas & Per Jambeck (2001) Developing Bioinformatics Computer 2. Skills: -Shroff Publishers & Distributors Pvt. Ltd (O’Reilly), Mumbai 3. HH Rashidi & LK Buehler (2002) Bioinformatics Basics: Applications in 4. Biological Science and Medicine, CRC Press, London 5. Des Higgins & Willie Taylor (2000) Bioinformatics: Sequence, structure and databanks. Oxford University Press 6. Baxevanis, A.D. & Ouellette, B.F.F. (2001). Bioinformatics: A practical guide to the analysis of genes and proteins – Wiley Interscience – New York 7. Arora PN & Malhon PK, (1996) Biostatistics. Imalaya Publishing House, Mumbai. 8. Sokal & Rohif, (1973) Introduction to Biostatistics - Toppan Co. Japan. 9. Stanton A & Clantz, Primer of Biostatistics –– The McGraw Hill Inc., New York |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
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| **SC 605** | | **MICROBIAL BIOCHEMISTRY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Isolation, cultivation and identification of bacteria** | |
| Isolation, cultivation and identification of bacteria. The bacteria cell wall structure. Gram positive and gram negative bacteria Microbial nutrition and growth. Bacterial growth and kinetics. Chemostatic culture Continuous cultivation of microbes,  Viruses –General structure, properties and classification. | | | |
| **Unit- II** | | **Fermentation** | |
| Fermentation– Types of fermentation processes- Batch,continous and fedbatch culture.Alcoholic fermentation, lactic acid fermentation. penicillin, riboflavin, glutamic acid,lysine, amylases and proteases Solid state fermentation. Sterilization and scale- up process | | | |
| **Unit-III** | **Basic design of fermentors** | | |
| Basic design of fermentors. types, aspetic operation, control systems, batch versus continuous operation, Tower fermenter, Air lift fermenter. . Aeration and Agitation. , Baffled, vortex and airlift systems, Impeller design, Effect of stirring, sparging and other parameters. Down-stream processing.  Introduction of secondary plant metabolite,terpenes (classification, biosynthesis), lignin, tannins, alkaloids, flavinoides | | | |
| **Unit-IV** | | | **Production of biomass** |
| Production of biomass (microbial insecticides, single cell proteins production). Production of low molecular weight compounds-primary and secondary metabolites.. Microbial polysaccharides. Production of enzymes (amylases proteases, lipases and cellulases) and high fructose syrup Microbiological mining Introduction to drug design | | | |
| **Unit-V** | | | **Antibiotics** |
| Antibiotics: Chemistry and biosynthesis of important antibiotic compounds. First, second, third and fourth generation antibiotics with reference to modified penicillins.Antibiotic resistence. Biochemical modes of action of antibiotics acting as inhibitors of ribosomal function (e.g., aminoglycosides, tetracyclines, puromycin, chloramphenicol etc.) inhibitors of nucleic acid metabolism, actinomycin D, mitomycin C etc. inhibitors of cell wall biosynthesis (penicillins, bacitracins etc.) and inhibitory of membrane function (polyenes, peptide antibiotics etc.) | | | |
| **Reference books** | | | 1. Microbial Biotechnology – Alexander N.Glazer, Hiroshni - Kaido, W.H.Freeman and Co.1995. 2. Chemical Microbiology, Antony H.Rose, Butterworths,Third Edition, Plenum Press,1976. 3. Principles of fermentation technology, P.F. Stanbury, A. Whitaker, S.J.Hall, Second Edition, Pergamon Publishers, 1995. 4. Biotechnology, A text of “Industrial Microbiology, Wulf Crueger and Anneliese Crueger , Second Edition, Sinauer Associates Inc, Sanderland, 1989c. 5. Animal Tissue Culture, Freshney, IRL Press,Fifth Edition, 1992 |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
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| **SC 607** | | **PLANT BIOTECHNOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to Plant tissue culture** | |
| Introduction to Plant tissue culture. Tissue culture media (composition and preparation).Totipotency; Cyto-differentiation. Initiation and maintenance of callus and suspension culture. Single cell culture. Organogenesis; Shoot-tip culture: rapid clonal propagation and production of virus-free plants. Transfer and establishment of whole plants in soil. | | | |
| **Unit- II** | | **Somatic Embryogenesis,** | |
| Somatic Embryogenesis, .Synthetic Seeds ,Embryo culture and embryo rescue. Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; cybrids. Another, pollen and ovary culture for production of haploid plants. Cryopreservation, Germplasm conservation., Inroduction of Transgenic plants and their application. | | | |
| **Unit-III** | **Plant Transformation Technology** | | |
| Plant Transformation Technology: Basis of tumor formation, hairy root, features of TI and RI plasmid, mechanisms of DNA transfer, use of TI and RI as vectors, binary vectors, and methods of nuclear transformation, direct DNA transfer methods : particle bombardment, electroporation, and microinjection. | | | |
| **Unit-IV** | | | **Chloroplast Transformation** |
| Chloroplast Transformation; advantages, vectors, success with tobacco and potato. Metabolic Engineering and industrial Products: plant secondary metabolites, biodegradable plastics, polyhydroxybutyrate, therapeutic proteins, edible vaccines .Plants culture, Tissues culture, cell Line culture ,stem cell culture and its application. | | | |
| **Unit-V** | | | **Conventional plant breeding** |
| Conventional plant breeding. Molecular Marker-aided Breeding: RFLP maps, linkage analysis, RAPD markers, AFLP ,microsatellites, SCAR (sequence characterized amplified region), SSCP (single strand conformation polymorphism), , molecular marker assisted selection. Arid and semi-arid plant biotechnology. Green house and green-home technology.,anti-sense RNA Technology,Introduction of plants hormones and its application. | | | |
| **Reference books** | | | 1. Metabolic activities of plant cells, John W. Anderson and John Beandall, Blackwell Scientific Publishers First Edition.1991. 2. Principles of gene manipuulation, Old,R.W. and Primrose,S.B., Blackwell Scientific Publishers, Fifth Edition, 1995. 3. .Plant Biochemistry and Molecular Biology – Hans, Walter and Heldt, Oxford UniversityPress,1997. 4. Plant Biochemistry ,Bonner &Varner, Academic press , Third Edition. 1976 5. Plant Biotechnology –Adrian Slater, Nigel Scot and Mark Fowler,Oxford University Press,2003. 6. Animal Biotechnology-Frashney 7. Biotechnology in crop improvement-Harvinder Singh Chawla, International Book DistributionCo.,1998. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 609** | | **MEDICAL MICROBIOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Pathogenic microorganisms** | |
| **Introduction:** Early discovery of pathogenic microorganisms; development of bacteriology as scientific discipline; contributions made by eminent scientists. Classification of medically important micro organisms.  Estsblishment, spreading, tissue damage and anti- phagocytic factors; mechanism of bacterial adhesion , colonization and invasion of mucous membranes of respritory, enteric and urinogenital tracts, Role of aggressins, depolymerising enzymes, organotropisms, variation and virulence. Organs and cells involved in immune system and immune response | | | |
| **Unit- II** | | **Chemical conditions and diagnosis** | |
| Chemical conditions and diagnosis of the following diseases.  **Disease**  **Pathogen**   * Pneumonia *Streptococcus pneumoniae* * Whooping –cough *Bordetalla pertusis* * Meningitis *Haemophlius influenzae* * Diptheria *Corynebacterium diphtheriae* * Pulmonary Tuberculosis *Mycobacterium tuberculoss* * Typhoid *Salmonella typhi* * Cholera *Vibrio cholerae* * Syphilis *Treponema pallidum* * Gonorrhea *Neisseria gonorrhoeae* * Dysentery *Shigella dyseneteriae*   Gasteroenteritis *Clostridium botulinum* | | | |
| **Unit-III** | **Classification of pathogenic bacteria** | | |
| Classification of pathogenic bacteria  *Staphylococcus*, *Streptococcus*, *Pneumococcu*s, *Neissseria*, *Cornebacterium, Bacillus*, *Clostridium*, Non sporing Anaerobes, Organisms belonging to *Enterobacteriacea*, *Vibrios*, Non fermenting gram negative bacilli *Yersinia*, *Haemophilus; Bordetella, Bucella*; *Mycobacteria*, S*pirochaetes*, *Actinomycste*s, *Rickettsiae*, *Chlamydiae*. | | | |
| **Unit-IV** | | | **Viral, protozoan and helminth** |
| Viral, protozoan and helminth – Common diseases  Virus: Small pox, Influenza, Measles, Poliomyelitis, Common cold (Rhino virus), Hepatitis, Encephalitis, Rabies, AIDS. Protozoa: Amoebiasis – Entamoeba *histolytic*, Malaria – Plasmodium *vivax*, P*. Malariae*. Helminths: Liver fluke – *Fasciola hepatica*, Filariosis – *Wauheria bancrofti*. Hospital acquired infection: Hospital infections Principles of control committee – functions; Hospital waste disposal – Ethical committee – functions. | | | |
| **Unit-V** | | | **Various methods of drug susceptibility testing** |
| Various methods of drug susceptibility testing, antibiotic assay in body fluids. Brief account of available vaccines and Schedules; passive prophylactic measures; Noscomical infection, common types of hospital infections and their diagnosis and control | | | |
| **Reference books** | | | 1. David Greenwood, Richard CD., Slack, John Forrest Peutherer. (1992). Medical Microbiology. 16th edition. ELBS with Churchill Livingstone. 2. Tom Parker, M., Leslie H. Collier (1990). Topley & Wilson’s Principles of Bacteriology, Virology and Immunity (VIII Edition). 3. Joan Stokes, E., Ridgway GL and Wren MWD (1993).Clinical Microbiology, 7th edition, Edward Arnold. A division of Holder and Stoughton. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 611** | | **ADVANCED CLINICAL BIOCHEMISTRY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Blood composition and its function** | |
| Blood composition and its function. Blood-Pressure ,Mechenism and regulation of blood coagulation. thalassemia. haemorrhagic disorder –haemophilia, purpura, porphyries ,circulating anticoagulants. sickle cell anemia  Synaptic transmission, Neurotransmitters and Neurohormones , Biochemistry of vision. | | | |
| **Unit- II** | | **Composition, functions and regulation of saliva** | |
| Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.  Structure of Nephron, Composition and formation of urine .Clinical significance of urinary components. homeostic regulation of water and electrolytes .Acid -Base balance, -Acidosis and Alkolosis. composition and biochemical analysis of CSF and amniotic fluid | | | |
| **Unit-III** | **Liver function test** | | |
| Liver function test and related disorder: Jaundice ,hepatitis, fatty liver and gall stone ,Cirrhosis.  Renal function test and related disorders ,Gastric and pancreatic function test .Diagnostic test for lipoproteins disorders. Obesity – Definition, Genetic and environmental factors leading to obesity | | | |
| **Unit-IV** | | | **Clinical significance of enzymes in health and diseases** |
| Clinical significance of enzymes in health and diseases. biochemical diagnosis of diseases by enzyme assays .SGOT, SGPT,CPK,alkaline phosphatase,cholinesterase and LDH. Inborn errors of metabolism: diabetes mellitus ,gaucher’s disease ,tay sach’s disease ,Niemann pick disease, phenylketonuria ,alkaptonuria ,albinism ,maple syrup disease ,lesch-nyhn syndrome. Sexual Transmitted Disease | | | |
| **Unit-V** | | | **Oncology** |
| Oncology – Cancer markers for oral Cancer, Breast cancer and gastrointestinal tract cancer. Alpha feto proteins, Carcino embryonic antigens, Leukemia. Free radicals in diseases - Introduction, Types of free radicals, free radical induced lipid peroxidation. Scavengers – Superoxide dismutase, catalase, peroxidase and antioxidants | | | |
| **Reference books** | | | 1.[Clinical Biochemistry: An Illustrated Colour Text, 4e](http://www.amazon.com/Clinical-Biochemistry-Illustrated-Colour-Text/dp/0443069328/ref=sr_1_1?s=books&ie=UTF8&qid=1334982547&sr=1-1) by Allan Gaw ,Michael J. Murphy (2008)2.[Marks' Basic Medical Biochemistry: A Clinical Approach](http://www.amazon.com/Marks-Basic-Medical-Biochemistry-Lippincott/dp/078177022X/ref=sr_1_2?s=books&ie=UTF8&qid=1334982547&sr=1-2) by Michael A. Lieberman and Allan Marks (2008)3.[Textbook of Biochemistry with Clinical Correlations](http://www.amazon.com/Textbook-Biochemistry-Clinical-Correlations-Thomas/dp/0470281731/ref=sr_1_4?s=books&ie=UTF8&qid=1334982547&sr=1-4) by Thomas M. Devlin .( 2010)4.[Clinical Chemistry: Techniques, Principles, Correlations](http://www.amazon.com/Clinical-Chemistry-Techniques-Principles-Correlations/dp/078179045X/ref=sr_1_5?s=books&ie=UTF8&qid=1334982547&sr=1-5)  by Michael L. Bishop, Edward P. Fody and Larry E. Schoeff (2009)5.[Clinical Biochemistry (Fundamentals of Biomedical Science)](http://www.amazon.com/Clinical-Biochemistry-Fundamentals-Biomedical-Science/dp/0199533938/ref=sr_1_6?s=books&ie=UTF8&qid=1334982547&sr=1-6) by Nessar Ahmed ( 2011)6.[Essentials of Medical Biochemistry: With Clinical Cases](http://www.amazon.com/Essentials-Medical-Biochemistry-Clinical-Cases/dp/0120954613/ref=sr_1_7?s=books&ie=UTF8&qid=1334982547&sr=1-7) by [N. V. Bhagavan](http://www.amazon.com/N.-V.-Bhagavan/e/B0044895UK/ref=sr_ntt_srch_lnk_7?qid=1334982547&sr=1-7) and Chung-Eun Ha ( 2011) 7.[Medical Biochemistry at a Glance](http://www.amazon.com/Medical-Biochemistry-at-Glance-Salway/dp/0470654511/ref=sr_1_8?s=books&ie=UTF8&qid=1334982547&sr=1-8) by [J. G. Salway](http://www.amazon.com/J.-G.-Salway/e/B001JS98CS/ref=sr_ntt_srch_lnk_8?qid=1334982547&sr=1-8) ( 2012) |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
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| **SC 613** | | **FERMENTATION TECHNOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to Bioprocess Engineering** | |
| Introduction to Bioprocess Engineering: Classification of Bioreactors, types, Design and operation of various types of reactors, main components, peripheral parts and accessories, various control systems specialized bioreactors (pulsed, fluidized, photo bioreactors etc). | | | |
| **Unit- II** | | **Isolation, Preservation and Media Requirements** | |
| Isolation and preservation of industrially important microorganisms - strain development mutation and recombination - upstream processing. Media for industrial fermentation - characteristics of an ideal production medium - raw material -screening for production media - media formulation - sterilization - (batch and continuous) - addition of antifoaming agents.. | | | |
| **Unit-III** | **Types of Fermentation processes** | | |
| Types of Fermentation processes: Batch ,fed batch and continuous bioreactors. Downstream processing: Introduction, Removal of microbial cells and solid matter, foam separation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, membrane process, Drying and crystallization, Whole Cell immobilization and their industrial applications. | | | |
| **Unit-IV** | | | **Industrial Production** |
| Industrial Production : Alcohol (ethanol) Acids (citric, acetic acid), solvents (glycerol, acetone), antibiotics (Penicillin, streptomycin,), Amino acids (lysine, glutamic acid), Enzymes (amylase, proteases), | | | |
| **Unit-V** | | | **Industrial Process Technology** |
| Industrial Process Technology, Single Cell Protein. Fermented beverages: beer and wine. Genetically modified foods. Biosensors - types and application in various industries | | | |
| **Reference books** | | | 1. Plant,Gene and Crop Bitechnol,M.J.chrispeel and D.E.Sadava ASPB 2003. 2. Economic Botany,S.L. Kocher. 3. Wastewater Engineering-Treatment,Disposal and Reuse,Metcall and Eddy,Inc.,Tala McGraw Hill,Delhi. 4. Comprehensive biotechnology, vol.4, M. Moo-Yound (Ed-in-chief),Pergamon Press,Oxford. 5. Environmental Chemistry,A.K.De,Willey Eastern Ltd.,New Delhi. 6. Introduction to Biodeterioration.D.Allsopp and K.J.Seal,ELBS/Edward Arnold. 7. Cookson,J.T.1995.Bioremediation Engineering:design and Application.McGraw-Hill,Inc. 8. Cheremisinoff,Nicholas P.Biotechnology for waste and wastewater treatment |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
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| **SC 617** | | **ANIMAL BIOTECHNOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | |  | |
| **Equipments and materials for animal cell culture technology :**  Primary and established cell line cultures.Balance salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium Role of carbon dioxide. Role of serum and supplements. | | | |
| **Unit- II** | |  | |
| **Introduction of media:** Serum & protein free defined media, advantages and disadvantages of serum and protein based media .measurement of viability and cytotoxicity. | | | |
| **Unit-III** |  | | |
| **Basic techniques:** of mammalian cell culture in vitro; disaggregation of tissue and primary culture; maintenance of cell culture; sub culture and cell line, cell strain, cell separation, methods for cell separation, cell characterization, cryopreservation, principle of cryopreservation, methods for cryopreservation | | | |
| **Unit-IV** | | |  |
| **Introduction of cloning :** Cell cloning, micromanipulation and types of cloning. Cell transformation. Application of animal cell culture, limitations of animal cell cultures.  Stem cell culture, embryonic stem cells and their applications. Organ and histotypic cultures. Three dimensional culture and tissue engineering | | | |
| **Unit-V** | | |  |
| **Manipulation and Reproduction :** Manipulation of Reproduction, in animals, artificial insemination, semen collection and storage ovulation, control, sperm sexing, embryo transfer, multiple ovulation (super ovulation) embryo splitting, embryo sexing, In vitro Fertilization Technology, Embryonic stem cell production. | | | |
| **Reference books** | | | 1. R.C. Dubey, 2006: A Text book of Biotechnology, S. Chand & Company Ltd. New Delhi 2. Bernard H.U. and Helinski, D.R. (1980):IN genetic Engg and principle and methods Vol. II Plenum press, New York. 3. Boffey, S. A. (1987): In Biotechnology , and Biological principles edition Trevan, M.D.,Boffey, England |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
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| **SC 619** | | **Food Microbiology** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | |  | |
| **Industrial Food fermentations**  Starter cultures their biochemical activities, production and preservation of the following fermented foods.  a. Soy sauce fermentation by Moulds  b. Fermented vegetables – Saurkraut  c. Fermented Meat – Sausages  d. Production and application of Bakers Yeast  e. Application of microbial enzymes in food industry | | | |
| **Unit- II** | |  | |
| **Quality Assurances in foods**  Foodborne infections and intoxications; bacterial wi th examples of infective and toxic types –,Clostridium, Salmonella, Shigella, Staphylococcus, Campylobacter, Listeria.Mycotoxins in food with reference to Aspergillus species.  Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. | | | |
| **Unit-III** |  | | |
| **Food Preservation methods**  Radiations - UV, Gamma and microwave, Temperature  Chemical and naturally occurring antimicrobials .Biosensors in food industry. | | | |
| **Unit-IV** | | |  |
| **Fermentation of Milk products and Beverages**  Microbiology of cheese and beverage fermentation.  Microbiology of fermented milk products (acidophilus milk, yoghurt).  Role of microorganisms in beverages – tea and coffee fermentations.Vinegar Fermentation | | | |
| **Unit-V** | | |  |
| **Advanced Food Microbiology**  Genetically modified foods. Biosensors in food, Applications of microbial enzymes in dairy industry [Protease, Lipases].  Utilization and disposal of dairy by-product – whey | | | |
| **Reference books** | | | 1. Food Microbiology. 2nd Edition By Adams  2. Basic Food Microbiology by Banwart George J.  3. Food Microbiology: Fundamentals and Frontiers by Dolle  4. Biotechnology: Food Fermentation Microbiology, Biochemistry and  Technology. Volume 2 by Joshi.  5. Fundamentals of Dairy Microbiology by Prajapati.  6. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.  7. Dairy Microbiology by Robinson. Volume II and I. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **SC 621** | | **BIOPROCESS TECHNOLOGY** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Introduction to Bioprocess Engineering**: | |
| Introduction to Bioprocess Engineering: Classification of Bioreactors, types, Design and operation of various types of reactors, main components, peripheral parts and accessories, various control systems specialized bioreactors (pulsed, fluidised, photobioreactors etc). Isolation preservation and maintenance of industrial microorganisms, media for industrial fermentation, Air and media sterilization. Strain selection and improvement. | | | |
| **Unit- II** | | **Types of Fermentation processes**: | |
| Types of Fermentation processes: Batch,fed batch and continuous bioreactors. Downstream processing: Introduction, Removal of microbial cells and solid matter, foam separation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, membrane process, Drying and crystallization, Whole Cell immobilization and their industrial applications. | | | |
| **Unit-III** | **Industrial Production of chemicals utilizing wastes** | | |
| Industrial Production of chemicals utilizing wastes: Alcohol (ethanol) Acids (citric, acetic acid), solvents (glycerol, acetone), antibiotics (Penicillin, streptomycin,), Aminoacids (lysine, glutamic acid), Single Cell Protein. Enzymes (amylase, proteases), | | | |
| **Unit-IV** | | | **Introduction Dairy Technology** |
| Introduction Dairy Technology: Principles of food processing,Elementary idea of canning and packing,sterilization and pasteurization of Food Products,Technology of typical Food/Food Products(bread,cheese idli),Food Preservation. Microbes as sources of food (*Spirulina*, *Saccharomyces cerviceae*, *Rhizopus* spp). Food borne infections and poisoning. | | | |
| **Unit-V** | | |  |
| Introduction of Food Technology**:** Fermented beverages: beer and wine. Genetically modified foods ,Microbiology of fermented milk – starter cultures, butter milk, cream yoghurt, kafir, kumiss, acidophilus milk and cheese. | | | |
| **Reference books** | | | 1. Plant,Gene and Crop Bitechnol,M.J.chrispeel and D.E.Sadava ASPB 2003. 2. Economic Botany,S.L. Kocher. 3. Wastewater Engineering-Treatment,Disposal and Reuse,Metcall and Eddy,Inc.,Tala McGraw Hill,Delhi. 4. Comprehensive biotechnology, vol.4, M. Moo-Yound (Ed-in-chief),Pergamon Press,Oxford. 5. Environmental Chemistry,A.K.De,Willey Eastern Ltd.,New Delhi. 6. Introduction to Biodeterioration.D.Allsopp and K.J.Seal,ELBS/Edward Arnold. Cookson,J.T.1995.Bioremediation Engineering:design and Application.McGraw-Hill,Inc. |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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| **HS 623** | | **SOFT SKILLS-III** | |
| **Prerequisite** | | All students are expected to have a general knowledge of biology and chemistry basic principles. | |
| **Learning objective** | | The learning objective of course are: To create an understanding regarding the life science, To gain knowledge about biotechnology, To have understanding about nature of damage, Able to analyse gene clonning management. | |
| **Salient features** | | The student will be able to conceptualize about tools and technique used in biotechnology, Able to understand instrumentation in lifescience. | |
| **Utility** | | A degree in life science opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and biochemist. | |
| **Unit-I** | | **Group Discussion** | |
|  | | | |
| **Unit- II** | | **Effective Interview** | |
|  | | | |
| **Unit-III** | **Conference and Seminar Organizing Skills** | | |
|  | | | |
| **Unit-IV** | | | **Scientific communication Skills** |
|  | | | |
| **Unit-V** | | | **Oral Delivery & Visual Aids** |
|  | | | |
| **Reference books** | | |  |
| **Mode of Examination** | | | Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT |
| **Recommended By BOS on:** | | |  |
| **Approved by academic council on:** | | |  |

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**SCHOOL OF SCIENCES**

**M.Sc. Biochemistry/Microbiology/Biotechnology**

**DETAILED SYLLABUS**

**DI 602 DISSERTATION/ PROJECT WORK C (L, T, P) = 14 (0, 0, 0)**

|  |  |
| --- | --- |
| **CLASS IV Sem M.Sc. Biochemistry/Microbiology/Biotechnology** | **EVALUATION** |
| Schedule Per Week  Practicals: | Examination Time = Three (3) Hours Max. Marks =100  [ Internal Assesment (60) & Semester End Exam (40)] |

The Project work will involve in depth practical work on a problem suggested by the supervisor of the candidate. The student will submit the dissertation of the work done. The dissertation submitted by the candidate shall be evaluated by one External expert ,Head of the Department and supervisor of the candidate. The examination shall be held in the department and the dissertation etc. will NOT be required to be mailed to the external examiner. The distribution of the marks will be as under.

Max. Marks:- 100

|  |  |
| --- | --- |
| Dissertation Record | 60 marks |
| Viva Voce | 40 marks |
| Total | 100 marks |

Scheme of Examination

General Guide-lines for Course of Study

1. The whole syllabus is divided into five units.
2. Number of teaching hours required to finish the contents of each unit are mentioned in the syllabus.
3. Books recommended/references are given at the end of each paper separately.
4. In P.G. programme list of periodicals for consultation are also given.
5. Two questions will be set from each unit and student will have to attempt one question from each unit.
6. Maximum time allowed for answering each question paper is 3 hours.
7. Maximum marks allotted to a paper are 70.

Examination Pattern

Evaluation will be done under two headings:

1. Theoretical Examination & Sessionals
2. Practical Examination & Sessional

**1. Theoretical Examination (100 Marks):**

This will be further divided under two categories

(i) Internal Assessment : 30 Marks (30% Component)

(ii) End term Assessment : 70 Marks (70% Component)

1. Internal Assessment (30 Marks): This is the 30% component of the total 100% theoretical examination & is further divided as follows

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Process** | Mid Term I | Mid Term II | Weekly Tests | Assignment | Total |
| **Marks** | 10 | 10 | 05 | 05 | 30 |

Two Mid Term Examinations, Two Weekly Tests per subject and two assignments from each unit will be conducted for assessment as per the following schedule:

* + After Completion of 1st Unit : Weekly test - I (to cover unit – I) and 2 assignments
  + After Completion of 2nd Unit : Mid Term Exam-I and 2 assignments (to cover unit 1 & 2)
  + After Completion of 3rd Unit : Weekly test – II (to cover unit 3)

and 2 assignment

* + After Completion of 4th Unit : Mid Term Exam – II & 2

assignments (to cover unit – 3 & 4)

* + After Completion of 5th Unit : End Term Exams & 2 assignments

(to covers all 5 units)

After completion of each unit, two assignments from each unit are to be given to the students, which will be submitted by the student after two working days. Thus total of 10 assignments will be assessed per semester. The Mid Term examination will be of 90 Min. duration and the concerned faculty members will be responsible for the question papers & evaluation.

Mid Term marks will be displayed within two working days of exams.

1. End Term Assessment (70 Marks): End term examination will be of 3.00 hrs duration and the question paper and the evaluation system will be as follows

**Question Paper:** For paper setting each subject, paper should be sent to three paper setters randomly and then any one paper will be selected randomly.

**Evaluation System:** Final result will be declared within one month after completion of examination. Centralized evaluation will be undertaken for End Term examinations.

**2. Practical Examination & Sessionals (100 Marks):**

The practical examination is also further divided into two categories i.e.

(i) Internal Assessment : 60 Marks (60% Component)

(ii) End Term Assessment : 40 Marks (40% Component)

(i) Internal Assessment (60 Marks): This is the 60% component of the total 100% practical examination and is further divided as follows

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Process** | Internal Exam | Attendance | File work | Presentations | Overall Performance | Viva  Voice | Total |
| **Marks** | 10 | 10 | 10 | 10 | 10 | 10 | 60 |

* The internal exam component will be awarded on the basis of total number of experiments conducted during the practical classes.
* Marks of attendance will be awarded based on percentage of attendance. The students will be detained if the total percentage falls below 75% in all subjects taken together.
* The file work will depend on the submission of detailed theory & experimented record.
* Overall presentation on the practicals performed during the semester will be taken into consideration for award of marks.
* Internal viva on the practicals performed will form the basis for award of marks in Viva-Voce.

1. End Term Assessment (40 Marks): This examination will be final practical examination the evaluation of the final examination should be done on same day as given below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Process** | Performance of the practical | Quiz | Viva voce | Total |
| **Marks** | 15 | 15 | 10 | 40 |

Mid-Term exams, weekly test and assignment will be reflected in the academic calendar.