**Core Subject MICROBIAL GROWTH AND METABOLISM**

**SEMESTER III Code:**

**5 Hrs/Week**

 **Credits 4**

**PREAMBLE**

* ***To enhance knowledge on microbial physiology and growth.***
* ***To ensure the students to understand the metabolism of Biomolecules.***

**COURSE OUTCOMES (CO)**

On Successful completion of the course, the student will be able to

|  |  |  |
| --- | --- | --- |
|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO 1** | Understand the Growth and reproduction, types, role of factors and Adaptation of Microorganisms  | K1  |
| **CO 2** | Acquired knowledge towards the Movement of molecule across the membrane by Facilitate, Passive and Active Transport system  | K1 and K2  |
| **CO 3** | Critically evaluate scientific information about mechanism of Photosynthesis in microorganisms, photosynthetic pigments and its types  | K2 and K3 |
| **CO 4** | Demonstrate aerobic respiration like Glycolysis, PPT, TCA, ETC and anaerobic respiration like fermentation of lactic acid, Alcoholic and mixed acid fermentation. | K3 |
| **CO 5** | Illustrate the Anabolism and Catabolism of lipids, Amino acids and Nucleic Acids  | K1, K2 and K3 |

K1 - Knowledge K2 - Understanding K3 - Application

UNIT – I: **[15 Hrs]**

 Growth and reproduction- batch and continuous culture – Growth curve – Factors affecting Microbial growth – oxygen, temperature, pH, pressure and osmosis. Reproduction – binary fission, budding and fragmentation. Stages of sporulation in bacteria – Extremophiles and its adaptation.

UNIT – II: **[15 Hrs]**

 Movement across membrane – transfer types – simple diffusion, facilitated diffusion, Active transport, Group translocation and Iron transport.

UNIT – III: **[15 Hrs]**

 Photosynthetic microorganisms – photosynthetic pigments, oxygenic and anoxygenic photosynthetic system, photosynthesis in purple sulfur bacteria.

UNIT – IV: **[15 Hrs]**

 Aerobic respiration – glycolysis, PPP, TCA, ETC and oxidative phosphorylation, substrate level phosphorylation, fermentation – Alcoholic fermentation, Acid fermentation and mixed acid fermentation.

UNIT – V: **[15 Hrs]**

 Biosynthesis of Lipids (Cholesterol) and catabolism (β- oxidation) of lipids, synthesis of aminoacids from aspartate, aromatic aminoacids synthesis, catabolism of Amino acids – urea cycle. Biosynthesis and breakdown of purines and pyrimidines.

**TEXT BOOKS:**

1. Cladwell D.R., Microbial Physiology and metabolism, W.M.C. Brown publishers, U S A, 1995.
2. Madigan M.T., Martinko J.M., and Jack parker, Brock biology of micro organism, 9th Edition, Prentics – Hall International, Inc, New Jersey, 2000.

**REFERENCE BOOKS :**

* 1. Nester E.W., Roberts C.E., and Nester M.T., Microbiology, A human perspective, C. Brown publishers inc, unit ( I –V), England, 1995.
	2. Mat A.G., and Foster J.W., Microbial physiological 2nd Edition, John wiley sons, USA, 1988.

**Pedagogy:**

Chalk and Talk

**WebResources: (URLs*:)***

**UNIT I:** 1.<https://www.ncbi.nlm.nih.gov/books/NBK2488/>

 2. <http://old-biomikro.vscht.cz/vyuka/ifm/Growth_curve.pdf>

**UNIT II:** 1. [https://courses.lumenlearning.com/boundless-ap/chapter/transport-across- membranes/](https://courses.lumenlearning.com/boundless-ap/chapter/transport-across-%20membranes/)

2.[https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A\_Microbiology\_(Bruslind)/11%3A\_Microbial\_Nutrition](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_%28Bruslind%29/11%3A_Microbial_Nutrition)

**UNIT III** 1.<https://en.wikipedia.org/wiki/Photosynthetic_pigment>

 2. <https://ucmp.berkeley.edu/glossary/gloss3/pigments.html>

**UNIT IV**1.<https://www.ck12.org/book/ck-12-biology/section/4.3/>

2. [https://www.khanacademy.org/science/biology/cellular-respiration-and- fermentation/glycolysis/a/glycolysis](https://www.khanacademy.org/science/biology/cellular-respiration-and-%20%20%20%20%20%20%20fermentation/glycolysis/a/glycolysis)

3.[https://openoregon.pressbooks.pub/mhccmajorsbio/chapter/7-5-aerobic- respiration-glycolysis/](https://openoregon.pressbooks.pub/mhccmajorsbio/chapter/7-5-aerobic-%20%20%20%20%20%20%20respiration-glycolysis/)

**Unit:V:**1.<https://www.kumc.edu/AMA-MSS/Study/lipids.htm>

2.<https://www.unifr.ch/biochem/assets/files/schneiter/cours/Voet_Pratt/Voet_chap_20_new.pdf>

3. <https://opentextbc.ca/anatomyandphysiology/chapter/24-4-lipid-metabolism/>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [15 Hrs] |
| 1.1 | Growth and reproduction-–. Reproduction –Stages  | 2 | Lecture | PPT |
| 1.2 | Batch and continous culture | 2 | Lecture | PPT, Black board |
| 1.3 | Growth curve  | 2 | Lecture | PPT |
| 1.4 | Factors affecting Microbial growth - oxygen, temperature, pH, pressure and osmosis | 4 | Lecture | PPT |
| 1.5 | Binary fission, budding and fragmentation. | 1 | Lecture | PPT |
| 1.6 | Sporulation in bacteria | 2 | Lecture | PPT |
| 1.7 | Extremophiles and its adaptation | 2 | Lecture | PPT |
| UNIT –II [15 Hrs] |
| 2.1 | Movement across membrane  | 3 | Lecture | PPT |
| 2.2 | Transfer types | 1 | Lecture | PPT |
| 2.3 | Simple diffusion, facilitated diffusion. | 4 | Lecture | PPT |
| 2.4 | Active transport | 2 | Lecture | PPT |
| 2.5 | Group translocation  | 3 | Lecture | PPT |
| 2.6 | Iron transport.  | 2 | Lecture | PPT |
| UNIT – III [15 Hrs] |
| 3.1 | Photosynthetic microorganisms  | 2 | Lecture | PPT |
| 3.2 | photosynthetic pigments | 1 | Lecture | Black board |
| 3.3 | Oxygenic photosynthetic system | 3 | Lecture | Black board |
| 3.4 | Dark reaction | 2 | Lecture | Black board |
| 3.5  | Light reaction | 2 | Lecture | Black board |
| 3.4 | Anoxygenic photosynthetic system | 3 | Lecture | PPT |
| 3.5 | photosynthesis in purple sulfur bacteria. | 2 | Lecture | PPT |
| UNIT – IV [15 Hrs] |
| 4.1 | Aerobic respiration fermentation  | 2 | Lecture | PPT |
| 4.2 | Glycolysis | 2 | Lecture | PPT |
| 4.3 | PPP | 2 |  |  |
| 4.4 | TCA | 2 | Lecture | PPT |
| 4.5 | ETC and oxidative phosphorylation | 2 | Lecture | PPT |
| 4.6 | Substrate level phosphorylation. | 2 | Lecture | PPT |
| 4.7 | Alcoholic fermentation, Acid fermentation and mixed acid fermentation. | 3 | Lecture | PPT |
| UNIT – V [15 Hrs] |
| 5.1 | Biosynthesis of Lipids (Cholesterol) | 2 | Lecture | PPT |
| 5.2 | Catabolism (β- oxidation) of lipids | 2 | Lecture | PPT |
| 5.3 | Synthesis of aminoacids from aspartate | 2 | Lecture | PPT |
| 5.4 | Synthesis of aromatic aminoacids. | 2 | Lecture | PPT |
| 5.5 | Catabolism of Aminoacids – urea cycle | 2 | Lecture | PPT |
| 5.6 | Biosynthesis and breakdown of purines | 2 | Lecture | PPT |
| 5.7 | Biosynthesis and breakdown of pyrimidines. | 3 | Lecture | PPT |

**MAPPING OF COs WITH POs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 1 | 2 | 2 | 1 |
| **CO2** | 3 | 2 | 1 | 1 | 3 |
| **CO3** | 2 | 2 | 1 | 1 | 2 |
| **CO4** | 3 | 2 | 1 | 2 | 3 |
| **CO5** | 2 | 2 | 2 | 1 | 1 |

3 - STRONG 2 - MEDIUM 1 - LOW

 **Course designer: Mr. T.MUTHURAYAR**

**Core Lab**  **LAB IN MICROBIAL METABOLISM Code:**

**SEMESTER III**

**3 Hrs/Week**

 **Credits 3**

***PREAMBLE:***

* ***To acquire practical skills in microbial growth rate determination and their influencing factors.***
1. Bacterial growth curve
2. Determination of generation time
3. Effect of pH on bacterial growth
4. Effect of temperature on bacterial growth
5. Effect of solutes on Bacterial growth
6. Effect of Nutrient (Carbon) on bacterial growth
7. Spore staining
8. Extraction of photosynthetic pigments from photosynthetic microorganisms
9. Chlorophyll
10. β - carotene

**REFERENCE BOOK:**

1. Rajamanikam, Current Protocols in Molecular Biology, Academic Press, M.K.U. Madurai, 2003.

**Course designer: Mr. T.MUTHURAYAR**

**Allied Bio Lab LAB IN GENETICS Code:**

 **SEMESTER III 2 Hrs/Week**

**(Common for B.Sc., Biotechnology and B.Sc., Microbiology)**

 **Credits 2**

***PREAMBLE :***

* ***To verify the patterns of inheritance by simple experiment in organisms.***
* ***To familiarize with clinical features of some common chromosomal disorders***
1. Study of human fingerprint
2. Study of Mendel’ s Law – Monohybrid and dihybrid experiments
3. Inheritance of physical characters in Man.
4. Inheritance of physiological characters in Man – Analysis of tasting activity by sodium benzoate.
5. Study of polytene chromosomes from salivary glands of

Chironomas larva.

1. Pedigree analysis
2. Spotters
3. Sickle cell aneamia
4. Huntingson disease
5. Haemophilia
6. Cystic fibrosis
7. Down syndrome
8. Kleinfelter syndrome
9. Colour blindness
10. Turner syndrome

**REFERENCE BOOKS:**

1. Peter Abram Off and Robert G. Thomson, an Experimental Approach t biology, 2nd Edition, W.H. Freeman and company Sanfrancisco.

**Course designer: Mrs. P. GAYATHRI DEVI**

**Part – IV INTRODUCTION TO MICROBIOLOGY Code:**

**Non-Major Electives -I SEMESTER IV**

**2 Hrs/Week**

 **Credits 2**

 ***PREAMBLE***

* **To gain knowledge on the morphology and cellular organelles of prokaryotes and eukaryotes.**
* **To acquire practical skill in microbial techniques.**
* **To acquire knowledge on role of micro organisms in food.**

**COURSE OUTCOMES (CO)**

On Successful completion of the course, the student will be able to

|  |  |  |
| --- | --- | --- |
|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO 1** | Understand the characteristic of bacteria, plant and animal cell, cell organelles, cell composition and difference between prokaryotic and eukaryotic cell. | K1 and K2 |
| **CO 2** | Demonstrate theory and practical skills in microscopy techniques. Working principle for laminar air flow, incubator. |  K2 andK3 |
| **CO 3** | To assess the role of micro organisms in meat and milk product and how to protect against microbes. |  K2 and K3 |
| **CO 4** | Gain a good understanding of pathogenesis, prevention and treatment for bacteria, fungi and parasites. | K2 and K3 |
| **CO 5** | Elucidate the reason for immunization and aware of vaccination schedule. |  K2 and K3 |

K1 - Knowledge K2 - Understanding K3 - Application

**UNIT – I:** **[6 Hrs]**

 Ultra structure of prokaryotic (Bacteria) and eukaryotic (Plant and Animal) cell.Difference between prokaryotic and eukaryotic cell.

**UNIT – II:** **[6 Hrs]**

 Working mechanism and applications of Bright field microscope, Laminar air flow, Incubator and Centrifuge.

**UNIT – III:** **[6 Hrs]**

 Microbial growth and Food Spoilage – Meat and Milk - Controlling of food spoilage – High temperature, Drying and Chemical preservation.

**UNIT – IV:**  **[6 Hrs]**

 Causative Organisms – Pathogenesis, prevention and treatment of disease – Typhoid fever, AIDS and Malaria.

 **UNIT – V:**  **[6 Hrs]**

Chemotherapy - Penicillin, Vaccines – Live attenuated vaccine (Oral polio vaccine) – Immunization schedule.

**TEXT BOOKS:**

1. PelczarJ.R.,Chan E.C.S., and Krieg R., Microbiology,5th Edition, Tata McGraw-Hill publishing company Limited, Delhi, 2004.
2. Dubay R.C., Text book of Biotechnology, S.Chand publishers, New Delhi

**REFERENCE BOOKS:**

1. Prescott L.M., Harley J.P., and Klein B.A., Microbiology,6th Edition ,McGraw-Hill Companies,New York,1993.
2. Bernard R., Click and Jack J, Pasternack. Molecular Biotechnology, American society for microbiology, London 2003. BBN.

**Pedagogy:**

Chalk and Talk

**Web resources: (URLs)**

**UNIT I:**<http://www.biologydiscussion.com/micro-biology/morphology-and-ultrastructure-of-a-bacterial-cell-with-diagram/17901>

**UNIT II:**<http://www.yourarticlelibrary.com/micro-biology/working-principle-and-parts-of-a-compound-microscope-with-diagrams/26509>

**UNIT III:**<http://www.simplynotes.in/food-biotechnology/milk-spoilagetypes-of-spoilage/>

**UNIT IV:**<https://www.medicalnewstoday.com/articles/156859>, <http://www.preservearticles.com/health/what-is-aids/685>

**UNIT V:** <https://www.vaccines.gov/basics/types>, <https://communitymedicine4asses.com/2018/12/16/national-immunization-schedule-2018-india/>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [6 Hrs] |
| 1.1 | Ultra structure of prokaryotic (Bacteria) | 2 | Lecture | PPT |
| 1.2 | Ultra structure of eukaryotic (Plant cell) | 1 | Lecture | Black board |
| 1.3 | Ultra structure of Eukaryotic (Animal  | 2 | Lecture | PPT |
| 1.4 | Difference between prokaryotic and eukaryotic cell. | 1 | Lecture | PPT |
| UNIT –II [6 Hrs] |
| 2.1 | Working mechanism and applications of Bright field microscope  | 2 | Lecture | PPT |
| 2.2 | Working mechanism and applications of Laminar air flow, | 1 | Lecture | PPT |
| 2.3 | Working mechanism and applications of Incubator | 1 | Lecture | PPT |
| 2.4 | Working mechanism and applications of Centrifuge. | 2 | Lecture | PPT |
| UNIT – III [6 Hrs] |
| 3.1 | Microbial growth and Food Spoilage – Meat  | 2 | Lecture | PPT |
| 3.2 | Microbial growth and Food Spoilage Milk  | 1 | Lecture | Charts, Animation |
| 3.3 | Controlling of food spoilage High temperature, Drying | 1 | Lecture | Black board |
| 3.4 | Chemical preservation | 2 | Lecture | PPT |
| UNIT – IV [6 Hrs] |
| 4.1 | Causative Organisms – Pathogenesis, prevention and treatment of disease –Introduction | 1 | Lecture | PPT |
| 4.2 | Pathogenesis, prevention and treatment of disease – Typhoid fever, | 2 | Lecture | PPT |
| 4.3 | Pathogenesis, prevention and treatment of disease – AIDS | 1 | Lecture | PPT |
| 4.4 | Pathogenesis, prevention and treatment of disease – Malaria  | 2 | Lecture | PPT,Charts |
| UNIT – V [6 Hrs] |
| 5.1 | Chemotherapy - Penicillin,  | 2 | Lecture | Static model |
| 5.2 | Vaccines – Live attenuated vaccine (Oral polio vaccine) | 2 | Lecture | PPT |
| 5.3 | Immunization schedule | 2 | Lecture | PPT |

**MAPPING OF COs WITH POs**

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| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 1 | 1 | 2 | 1 | 1 |
| **CO2** | 2 | 1 | 1 | 2 | 3 |
| **CO3** | 3 | 3 | 1 | 2 | 2 |
| **CO4** | 3 | 3 | 1 | 2 | 3 |
| **CO5** | 3 | 3 | 1 | 3 | 3 |

3 – STRONG 2 - MEDIUM 1 – LOW

 **Course designer: Mrs. M. SHYAMALA**

**Part – IV PRINCIPLES OF GENETICS Code:**

**Skill Based Elective SEMESTER III**

**(Common for both B.Sc., Biotechnology and B.Sc., Microbiology)**

 **2 Hrs/Week**

 **Credits 2**

***PREAMBLE***

* ***To understand the basic process of gene transmission.***
* ***To have some familiarity with genetic resources and informations.***

**COURSE OUTCOMES (CO)**

On Successful completion of the course, the student will be able to

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|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO 1** | Understand the laws of inheritance Mendelian genetics, epistasis and relationship between phenotype and genotype in human genetic traits. | K1 |
| **CO 2** | Learn the knowledge on alleles and their linkage, crossing over and sex linked inheritance. | K2 and K3  |
| **CO 3** | Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders. | K1 and K3 |
| **CO 4** | Learn about quantitative traits and Hardy-Weinberg law. | K2 and K3 |
| **CO 5** | Know the role of human genetics, Simple Mendelian traits and Inborn errors of metabolism in human populations | K2 and K3 |

K1 - Knowledge K2 - Understanding K3 - Application

UNIT – I: **[6 Hrs]**

Mendelian genetics –terminology and law, Experiment– Monohybrid and Dihybrid cross, Non-allelic gene interaction- epistasis, Multiple alleles- Blood Group Inheritance.

UNIT – II: **[6 Hrs]**

Polygenic Inheritance – Skin colour in Man, Gene linkage and Crossing over - types of crossing over - Sex linked inheritance- X and Y linked inheritance.

UNIT – III: **[6 Hrs]**

Variation in chromosome structure and number*-* Ploidy – Types, Philadelphia chromosome, Chromosomal disorders – Turner syndrome, down syndrome &klinefelter syndrome

UNIT – IV: **[6 Hrs]**

Population Genetics – Gene Pool, Hardy – Weinberg Law, Gene Frequency Calculations, factors affecting Hardy – Weinberg Law.

UNIT – V: **[6 Hrs]**

Human Genetics *-* Pedigree Analysis, Simple Mendeliantraits, Twins, Inborn Errors of Metabolism – Phenyl Ketonuria and Type 1 - diabetes.

**TEXT BOOKS:**

1. Verma P.S., and Agarwal V.K., Genetics, S.Chand and Co., New Delhi, 1998.

**REFERENCE BOOKS:**

1. Gardner E.J., Simmons M.J., and Snustad D.P., Principles of Genetics, 8th Edition, John Wiley and Sons, Inc New York, 1991.
2. Robert J., Brooker, Genetics Analysis and Principles, ADDISON–WSSLEY, Menlo Park, 1999.

**Pedagogy:**

Chalk and Talk

**Web resources: (URLs)**

**Unit I:**<https://www.nature.com/scitable/topicpage/gregor-mendel-and-the-principles-of-inheritance-593/>

**Unit II:**<https://study.com/academy/lesson/chromosomal-linkage-and-crossing-over.html>

**Unit III:**<https://www.yourgenome.org/facts/what-is-a-chromosome-disorder>

**Unit IV:**<https://en.wikipedia.org/wiki/Population_genetics>

**Unit V:**<https://en.wikipedia.org/wiki/Human_genetics>

<https://en.wikipedia.org/wiki/Inborn_errors_of_metabolism>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [6 Hrs] |
| 1.1 | Mendelian genetics –terminology and law, Non-  | 2 | Lecture | PPT |
| 1.2 | Experiment– Monohybrid and Dihybrid cross, | 2 | Lecture | Black board |
| 1.3 | allelic gene interaction- epistasis, | 1 | Lecture | PPT |
| 1.4 | Multiple alleles- Blood Group Inheritance. | 1 | Lecture | PPT |
| UNIT –II [6 Hrs] |
| 2.1 | Polygenic Inheritance – Skin colour in Man. | 2 | Lecture | PPT |
| 2.2 | Gene linkage and its types | 1 | Lecture | PPT |
| 2.3 | Crossing over - types of crossing over | 1 | Lecture | PPT |
| 2.4 | Sex linked inheritance- X and Y linked inheritance. | 2 | Lecture | PPT |
| UNIT – III [6 Hrs] |
| 3.1 | Variation in chromosome structure and number*-* Ploidy – Types | 2 | Lecture | PPT |
| 3.2 | Philadelphia chromosome | 1 | Lecture | Black board |
| 3.3 | Chromosomal disorders – Turner syndrome, | 1 | Lecture | Black board |
| 3.4 | Downsyndrome & klinefelter syndrome  | 2 | Lecture | PPT |
| UNIT – IV [6 Hrs] |
| 4.1 | Population Genetics – Gene Pool. | 2 | Lecture | PPT |
| 4.2 | Hardy – Weinberg Law | 2 | Lecture | Black board |
| 4.3 | Gene frequency calculations | 1 | Lecture | Black board |
| 4.4 | factors affecting Hardy – Weinberg Law  | 1 | Lecture | Black board |
| UNIT – V [6 Hrs] |
| 5.1 | Human Genetics *-* Pedigree Analysis  | 2 | Lecture | Black board |
| 5.2 | Simple Mendelian traits, Twins, | 2 | Lecture | PPT |
| 5.3 | Inborn Errors of Metabolism – Phenyl Ketonuria and Type 1 - diabetes. | 2 | Lecture | PPT |

**MAPPING OF COs WITH POs**

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| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | **2** | **3** | **2** | **1** | **2** |
| **CO2** | **3** | **2** | **1** | **2** | **3** |
| **CO3** | **2** | **3** | **3** | **1** | **2** |
| **CO4** | **3** | **2** | **1** | **2** | **2** |
| **CO5** | **2** | **3** | **2** | **3** | **3** |

**3 - STRONG 2 - MEDIUM 1 - LOW**

**Course designer: Dr. C. KARTHIKEYAN**

**Core Subject MOLECULAR BIOLOGY Code:**

**SEMESTER IV**

**5 Hrs/Week**

 **Credits 4**

**PREAMBLE**

* ***To provide the knowledge about how cells develop, operate, communicate and control their activities.***
* ***To give adequate information on biological based gene transfer methods***
* ***To acquire the information on mutation of DNA and their repair mechanism***

**COURSE OUTCOMES (CO)**

On Successful completion of the course, the student will be able to

|  |  |  |
| --- | --- | --- |
|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO 1** | Understanding of the various aspects of DNA Structure, Withstanding and coiling features | K1  |
| **CO 2** | Demonstrate advanced, contemporary and relevant knowledge in replication system of prokaryotes | K1 and K2  |
| **CO 3** | Summarize the gene expression mechanism and their regulatory systems of various operon concepts | K2 and K3 |
| **CO 4** | Elucidate the Gene transfer methods like transformation, Conjugation and Transduction and gathering the evidences for DNA as genetic material | K2 and K3 |
| **CO 5** | . Explain the mutations, causing agents, repair system and mechanism of transposition | K1, K2 and K3 |

K1 - Knowledge K2 - Understanding K3 - Application

UNIT – I: **[15 Hrs]**

 Molecular basis of life, principle, scope and application - DNA & RNA structure, properties – Supercoiling, DNA denaturation and renaturation.

UNIT – II: **[15 Hrs]**

 Bacterial DNA replication. Mode of replication- conservative, semi-conservative and dispersive; Role of enzymes in replication – Mechanisms of replication- Initiation, elongation and termination. Rolling circle model and Theta model of replication.Transcription in Prokaryotes- Features, Mechanism of transcription- Initiation, elongation and termination. Genetic code.

UNIT – III: **[15 Hrs]**

 Concepts of operons - lac operon and trp operon and their regulations.Translation – Initiation, Elongation, Termination and Post translational modifications.

UNIT – IV: **[15 Hrs]**

 Gene transfer mechanisms – Transformation – definition, Griffith experiment, Mechanism. Conjugation - definition, types, F – mediated, Hfr mediated, F – mediated Sexduction. Transduction - definition, types, and mechanism. DNA as a genetic material.

UNIT – V: **[15 Hrs]**

 Mutation & Mutagenesis – Definition, types, DNA damage and repair mechanism. Transposons and Insertion elements.

**TEXT BOOKS:**

1. Benjamin Lewin, Gene VII. Oxford University Press, Oxford, 2003.
2. David Freifelder, Molecular Biology, 2nd Edition, Narosa Publishing House, New Delhi, 1990.

**REFERENCE BOOKS :**

* 1. Cullis T., Burton, Guhman S., Antony Griffiths, David Suzuki, Genetics: A Beginner’s Guide. One World Publication Limited 2003.
	2. De Robertis, E.D.P. and DeRobertis, E.M.F., Essentials of Cell and Molecular Biology, Holt Saunders Publication, Philadelphia 1981.

**Pedagogy:**

Chalk and Talk

**WebResources: (URLs:)**

UNIT I**:** 1.https://www.livescience.com/37247-dna.html

2. <https://www.scienceabc.com/pure-sciences/dna-replication-steps-diagram-where-when-replication-occurs.html>

UNIT II: 1. <https://microbenotes.com/rna-properties-structure-types-and-functions/>

 2. <https://www.britannica.com/science/RNA>

UNIT III

1. <http://www.biologydiscussion.com/cell/prokaryotes/translation-in-prokaryotes-genetics/38022>

 2 <https://microbenotes.com/lac-operon/>

 3. <https://microbenotes.com/post-translational-modification/>

 4. <https://microbenotes.com/tryptophan-trp-operon/>

UNIT IV 1.<https://byjus.com/biology/dna-genetic-material/>

 2. <https://www.onlinebiologynotes.com/bacterial-transformation/>

 3. <https://www.onlinebiologynotes.com/bacterial-conjugation/>

 4. <https://www.bioexplorer.net/bacterial-transduction.html/>

Unit V:

1. [http://www.eujournal.org/index.php/esj/article/viewFile/2518/ 2391](http://www.eujournal.org/index.php/esj/article/viewFile/2518/%202391)

 2. <http://www.biologydiscussion.com/bacteria/mutation-and-repair-of-damaged-dna-in-bacteria/51015>

 3. <http://www.biologydiscussion.com/biotechnology/transposons-definition-and-types-with-diagram/17769>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [15 Hrs] |
| 1.1 | Molecular basis of life, principle, scope and application  | 4 | Lecture | PPT |
| 1.2 | DNA structure and properties | 4 | Lecture | PPT, Black board |
| 1.3 | RNA structure and properties |  3 | Lecture | PPT |
| 1.4 | Supercoiling, DNA denaturation and renaturation. | 4 | Lecture | PPT |
| UNIT –II [15 Hrs] |
| 2.1 | Bcaterial DNA replication.- Introduction  | 1 | Lecture | PPT |
| 2.2 | Mode of replication- conservative, semiconservative and dispersive; | 2 | Lecture | PPT |
| 2.3 | Role of enzymes in replication – Mechanisms of replication- Initiation, elongation and termination | 4 | Lecture | PPT |
| 2.4 | Rolling circle model and Theta model of replication. | 3 | Lecture | PPT |
| 2.5 | Transcription in Prokaryotes- Features, Mechanism of transcription- Initiation, elongation and termination. | 3 | Lecture | PPT |
| 2.6 | Genetic code.  | 2 | Lecture | PPT |
| UNIT – III [15 Hrs] |
| 3.1 | Concepts of operons - lac operon and their regulations. and  | 3 | Lecture | PPT |
| 3.2 | trp operon and their regulations | 3 | Lecture | Black board |
| 3.3 | Translation – Initiation, Elongation, Termination | 5 | Lecture | Black board |
| 3.4 | Post translational modifications.  | 4 | Lecture | Black board |
| UNIT – IV [15 Hrs] |
| 4.1 | Gene transfer mechanisms – Transformation – definition, Griffith experiment, Mechanism.  | 5 | Lecture | PPT |
| 4.2 | Conjugation - definition, types, F – mediated, | 4 | Lecture | PPT |
| 4.3 | Hfr mediated, F – mediated Sexduction. . | 3 |  |  |
| 4.4 | Transduction - definition, types, and mechanism. DNA as a genetic material | 3 | Lecture | PPT |
| UNIT – V [15 Hrs] |
| 5.1 | Mutation & Mutagenesis – Definition  | 4 | Lecture | PPT |
| 5.2 | Types of Mutation | 3 | Lecture | PPT |
| 5.3 | DNA damage and repair mechanism. | 4 | Lecture | PPT |
| 5.4 | Transposons and Insertion elements | 4 | Lecture | PPT |

**MAPPING OF COs WITH POs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 2 | 1 | 2 | 1 | 2 |
| **CO2** | 2 | 2 | 1 | 2 | 3 |
| **CO3** | 1 | 2 | 3 | 1 | 2 |
| **CO4** | 3 | 1 | 2 | 2 | 1 |
| **CO5** | 2 | 3 | 2 | 1 | 3 |

3 - STRONG 2 - MEDIUM 1 - LOW

 **Course designer: Mr. T. MUTHURAYAR**

**Core Lab LAB IN MOLECULAR BIOLOGY**

 **SEMESTER IV Code:**

**3 Hrs/Week**

 **Credits 3**

***PREAMBLE:***

* ***To gain and understand some of the principles and basic techniques in Molecular biology.***
1. Isolation of DNA from Bacteria.
2. Induction of Mutation by UV Mutagenesis.
3. Isolation of antibiotic resistant strains by gradient plate technique.
4. Isolation of Auxotrophic mutants by replica plating.
5. Transformation of DNA into *E.coli* by calcium chloride precipitation method.
6. F+ × F- Conjugation in *E.coli*.
7. Determination of Phage titre (T4), value.
8. Preparation of high titre phage lysate.
9. Induction of beta – Galactosidase.
10. Industrial visit

**TEXT BOOKS:**

1. Joseph Sambrook, David N. Russell, Joe Sambrook, Molecular Cloning: A Laboratory Manual (3-Volume set), Cold Spring Harbor Press 2001, USA.
2. Rajamanikam, Current Protocols in Molecular Biology, Academic Press, M.K.U. Madurai, 2003.

**REFERENCES:**

* 1. Gerhardt. P, Murray R.G.F., Wood WA., and Kreig NR., - Methods for General and Molecular Bacteriology, 2nd Edition, Blackwell Publishing, USA.1994.
	2. Miller H., Experiments in Molecular Genetics, Cold Spring Harbor Press USA, 1977.

**Course designer: Mr. T. MUTHURAYAR**

**Part – IV APPLIED MICROBIOLOGY Code:**

**Non-Major Electives - II SEMESTER IV**

**2 Hrs/Week**

 **Credits 2**

***PREAMBLE:***

* **To gain knowledge on the morphology and cellular organelles of prokaryotes and eukaryotes.**
* **To acquire practical skill in microbial techniques.**
* **To acquire knowledge on role of micro organisms in food.**

**COURSE OUTCOMES (CO)**

On Successful completion of the course, the student will be able to

|  |  |  |
| --- | --- | --- |
|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO 1** | Develop an understanding about the preparation and application of *Rhizobium, Mycorrhizae*, vermicompost.  | Up to K3 |
| **CO 2** | Acquire the knowledge of biotechnology in food production and processing of yoghurt, idly and pickles | Up to K3 |
| **CO 3** | Demonstrate the various techniques to know about the production of mushroom, beer, wine and vitamin B12. | Up to K3 |
| **CO 4** | Understand the important role of micro organisms in maintain healthy environment by using biodegradation of pesticide , biogas and waste water treatment | Up to K3 |
| **CO 5** | Summarize the methods used to produce transgenic plant and explain the selection process of synthetic seeds | Up to K3 |

K1 - Knowledge K2 - Understanding K3 - Application

UNIT – I: **[6 Hrs]**

 Fertilizer preparation and its applications – Rhizobium, Mycorrhizae and Vermicomposting.Bacterial pestisides - Bacillus thuringiensis.

UNIT – II: **[6 Hrs]**

 Fermented food products – yoghurt, idly, bread and pickles – preparation and its advantages

UNIT – III: **[7 Hrs]**

 SCP (Spirulina) - Mushroom production (Oyster mushroom) - alcoholic beverages – Beer, wine productions - Vitamin B12 production.

UNIT – IV: **[6 Hrs]**

 Biodegradation of pesticides (DDT), Biogas-Methane, Waste water treatment.

 UNIT – V: **[5 Hrs]**

 Transgenic animals (sheep) – transgenic plants (golden rice) and Definition and uses of synthetic seeds

**TEXT BOOKS:**

1. Casida J.F., Industrial Microbiology, Wiley Eastern Ltd., New Delhi, 1968.
2. Alexander N., Glazer and Hiroshi Nikaido, Microbial Biotechnology, Freeman W.H. and Co. New York, 1995

**REFERENCE BOOKS:**

1. Banwart J., Basic Food Microbiology, CBS Publishers and Distributors, New Delhi, 1987.
2. Campbell W., Robinson and John A., Howell, Comprehensive Biotechnology, Volume I, II, III and IV, Elsevier Publications, Oxford, England, 2004.

**Pedagogy:**

Chalk and Talk

**Web resources: (URLs)**

 UNIT I: <https://www.slideshare.net/PavanKundur/rhizobium-biofertilizer-mass-production>, <https://byjus.com/biology/vermicomposting/>

UNIT II: <https://www.hengel.com/en/bread-fermentation-methods.html>

UNIT III: <https://www.mushroomcouncil.com/growing-mushrooms/six-steps-to-mushroom-farming/>

UNIT IV: <https://www.owlgen.com/question/write-a-short-note-on-biogas/>, <https://www.cliffsnotes.com/study-guides/biology/microbiology/aquatic-microbiology/sewage-and-wastewater-treatment>

UNIT V: <http://biology-pages.info/T/TransgenicAnimals.html>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [6 Hrs] |
| 1.1 | Fertilizer preparation and its applications– Rhizobium,  | 2 | Lecture | PPT |
| 1.2 | Fertilizer preparation and its applications - Mycorrhizae  | 1 | Lecture | Black board |
| 1.3 | Fertilizer preparation and its applications –. Vermicomposting. | 1 | Lecture | PPT |
| 1.4 | Fertilizer preparation and its applications - Bacterial pestisides -Bacillus thuringiensis | 2 | Lecture | PPT |
| UNIT –II [6 Hrs] |
| 2.1 | Fermented food products – yoghurt,– preparation and its advantages | 2 | Lecture | PPT |
| 2.2 | Fermented food products –idly preparation and its advantages | 1 | Lecture | PPT |
| 2.3 | Fermented food products – bread preparation and its advantages | 1 | Lecture | PPT |
| 2.4 | Fermented food products – pickles preparation and its advantages | 2 | Lecture | PPT |
| UNIT – III [ 7 Hrs] |
| 3.1 | SCP (Spirulina) production | 2 | Lecture | PPT |
| 3.2 | Mushroom production (Oyster mushroom) | 1 | Lecture | PPT |
| 3.3 | alcoholic beverages – Beer, wine  |  2 | Lecture | Black board |
| 3.4 |  Vitamin B12 production | 1 | Lecture | PPT |
| UNIT – IV [6 Hrs] |
| 4.1 | Biodegradation of pesticides (DDT),  | 2 | Lecture | PPT |
| 4.2 | Biogas-Methane, | 2 | Lecture | PPT |
| 4.3 | Waste water treatment - Introduction | 1 | Lecture | PPT |
| 4.4 | Methods for Waste water treatment. | 1 | Lecture | PPT |
| UNIT – V [6 Hrs] |
| 5.1 | Transgenic animals (sheep)  | 2 | Lecture | PPT |
| 5.2 | Transgenic plants (golden rice)  | 2 | Lecture | PPT |
| 5.3 | Definition and uses of synthetic seeds | 2 | Lecture | PPT |

**MAPPING OF COs WITH POs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 1 | 2 | 3 |
| **CO2** | 3 | 3 | 1 | 2 | 2 |
| **CO3** | 2 | 3 | 1 | 3 | 3 |
| **CO4** | 3 | 3 | 1 | 3 | 3 |
| **CO5** | 3 | S | 1 | 3 | 3 |

3**-** Strong 2- Medium 1- low

**Course designer: Mrs. M.SHYAMALA**

**Skill Based Electives EVOLUTION Code:**

**(Common for both B.Sc., Biotechnology and B.Sc., Microbiology) SEMESTER IV 2 Hrs/Week**

 **Credits 2**

**PREAMBLE:**

* ***To understand the processes and patterns of biological evolution, and the role of evolution as the central unifying concept in biology.***
* ***To learn the evolutionary relationships among major groups of organisms.***

**COURSE OUTCOMES (CO)**

On Successful completion of the course, the student will be able to

|  |  |  |
| --- | --- | --- |
|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO 1** | To understand the evolutionary theories in pre Darwin era to relate it with the current features phylogenetically. | K1 and K2 |
| **CO 2** | Understand the propositions underlying Darwin’s theory of evolution through natural selections and to analyse the need for other concepts to support evolution | K1 and K2  |
| **CO 3** |  Illustrate the characteristic attributes of genetic diversities and mechanisms. |  K2 and K3 |
| **CO 4** | Demonstrate the inter relationships between morphology, physiological, biochemical and paleontological evidences. | K1, K2 and K3 |
| **CO 5** | Critically analyze the organic evolution, adaptive radiation and species extinction. | K2 and K3  |

K1 - KNOWLEDGE K2 - UNDERSTANDING K3 – APPLICATION

UNIT – I: **[6 Hrs]**

 Origin of life- Abiogenesis, Biogenesis, Cosmozoic theory and Biochemical origin of life - Urey and Miller’s Experiment.

UNIT – II: **[6 Hrs]**

 Evolution theories- Lamarckism; Darwinism- Natural selection; Modern Synthetic theory of evolution.

UNIT – III: **[6 Hrs]**

 Polymorphism- Types; Genetic Drift; Patterns of Evolution - Divergent, convergent, parallel and co-evolution. Speciation- Types of Speciation (Allopatric, Sympatric and Parapatric); Isolating mechanism.

UNIT – IV: **[6 Hrs]**

 Evidences of evolution- Evidences from Morphology, Physiological and Biochemical evidences and Palentological evidences

UNIT – V: **[6 Hrs]**

Adaptation; Organic evolution of Man; Fossils- formation, types of fossils; Extinction of species - Types and causes

**TEXT BOOKS:**

1. Arumugam. N, Organic Evolution, Saras Publication. 1992

**REFERENCE BOOKS:**

1. Sylvia S. Mader, Biology, 5th Edition McGraw. Hill.1996
2. Moody. P. A, Introduction to Evolution, Kalyani publication, New Delhi. 1995
3. Strickberger, Evolution, EIBS publishers. 1994

**Pedogogy:**

Chalk & Talk

**WEB RESOURCES: (URLs)**

Unit I: <https://www.toppr.com/guides/biology/evolution/theories-of-origin-and-evolution-of-life/>.

 <https://www.slideshare.net/nasirshaikh5/origin-and-evolution-of-life>.

Unit II: <https://www.slideshare.net/Taqiahmad007/evolution-theories-45650245>.

Unit III: [https://en.wikipedia.org/wiki/Polymorphism\_(biology)](https://en.wikipedia.org/wiki/Polymorphism_%28biology%29).

 <https://www.slideshare.net/towanda7979/speciation-powerpoint>.

Unit IV: <https://www.slideshare.net/coachpointer/evidences-of-evolution-11463159>.

Unit V: <https://www.slideshare.net/100000752091558/4human-evolution>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [6 Hrs] |
| 1.1 | Origin of life | 1 | Lecture | PPT |
| 1.2 | Abiogenesis, Biogenesis | 1 | Lecture | PPT |
| 1.3 | Cosmozoic theory  | 1 | Lecture | PPT, Black board |
| 1.4 | Biochemical origin of life  | 2 | Lecture | PPT |
| 1.5 | Urey and Miller’s Experiment. | 1 | Lecture | PPT |
| UNIT –II [6 Hrs] |
| 2.1 | Evolutiontheories  | 1 | Lecture | PPT |
| 2.2 | Lamarckism | 1 | Lecture | PPT |
| 2.3 | Darwinism | 1 | Lecture | PPT |
| 2.4 | Natural selection Theory | 2 | Lecture | PPT |
| 2.5 | Modern Synthetic theory of evolution  | 1 | Lecture | PPT |
| UNIT – III [6 Hrs] |
| 3.1 | Polymorphism - Types | 1 | Lecture | PPT |
| 3.2 | Genetic Drift | 1 | Lecture | Black board |
| 3.3 | Patterns of Evolution - Divergent, convergent | 1 | Lecture | Black board |
| 3.4 | parallel and co-evolution | 1 | Lecture | PPT |
| 3.5  | Types of Speciation (Allopatric, Sympatric and Parapatric | 1 | Lecture | PPT |
| 3.6 | Isolating mechanism | 1 | Lecture | PPT |
|  |  |  |  |  |
| UNIT – IV [6 Hrs] |
| 4.1 | Evidences of evolution  | 1 | Lecture | PPT |
| 4.2 | Evidences from Morphology | 1 | Lecture | PPT |
| 4.3 | Physiological evidences | 1 | Lecture | PPT |
| 4.4 | Biochemical evidences | 1 | Lecture | PPT |
| 4.5 | Palentological evidences | 1 | Lecture | PPT |
| 4.6 | Genetial evidences | 1 | Lecture | PPT |
| UNIT – V [6 Hrs] |
| 5.1 | Adaptation | 1 | Lecture | PPT |
| 5.2 | Organic evolution of Man | 1 | Lecture | PPT |
| 5.3 | Fossils- formation | 1 | Lecture | PPT |
| 5.4 | Types of fossils | 1 | Lecture | PPT |
| 5.5 | Extinction of species | 1 | Lecture | PPT |
| 5.6 | Types and causes of Extinction | 1 | Lecture | PPT |

**Mapping with COs with POs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 2 | 1 | 2 | 2 | 1 |
| **CO2** | 3 | 2 | 1 | 1 | 2 |
| **CO3** | 2 | 3 | 2 | 1 | 3 |
| **CO4** | 2 | 1 | 3 | 2 | 2 |
| **CO5** | 1 | 3 | 1 | 2 | 2 |

3**-** Strong 2- Medium 1- low

**Course designer: Dr. T. SIVAGAMASUNDARI**