**Core Subject MOLECULAR BIOLOGY Code:**

**SEMESTER III**

**5 Hrs/Week**

 **Credits 4**

***PREAMBLE***

* ***This course is to have a firm foundation in the fundamentals of Molecular Biology***
* ***Students become able to study the genes (DNA) and their inheritance at molecular level as well as get the knowledge of molecular biology.***

**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** | It introduces the molecules that play a key role in biology, Understand and apply the principles , techniques of molecular biology and the Central dogma of life, main structural elements and processes that participate in replication, regulation of bacteria  | K1  |
| **CO 2** | Gain knowledge towards the RNA, types, mechanism of transcription and coding sequences of Amino acids  | K1 and K2  |
| **CO 3** | Critically evaluate genetic information expression mechanism, Develop an understanding of their regulatory systems of operon concepts.  | K2 and K3 |
| **CO 4** | Demonstrate the DNA as a genetic material and Gene transfer mechanisms  | K2 and K3 |
| **CO 5** | Explain the emergence of mutations and their influence of, on the survival of individuals and species with the proposal of the repair system and learn about the transposition mechanism of Transposon  | K1, K2 and K3 |

K1 - Knowledge K2 - Understanding K3 – Application

UNIT – I: **[15 Hrs]**

 Central dogma of life, DNA structure, types and properties; DNA replication models and mechanism of replication in prokaryotes.

UNIT – II: **[15 Hrs]**

 RNA structure, types, properties, difference between DNA & RNA, mechanism of transcription in Prokaryotes and Post transcriptional modification. Genetic code.

UNIT – III: **[15 Hrs]**

 Translation - Mechanism of translation in Prokaryotes – Post translational modification – transcription coupled translation; Concepts of operons - lac operon and trp operon and their regulations.

UNIT – IV: **[15 Hrs]**

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

UNIT – V: **[15 Hrs]**

 Mutation – Definition, types, agents – Physical and Chemical - DNA damage and repair mechanism. Transposons types, structure and Mechanism of transposition.

**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.

**Pedogogy:**

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-](https://www.scienceabc.com/pure-sciences/dna-replication-steps-%20%0D%20%20%20%20%20%20%20diagram-where-when-replication-occurs.html)

 [diagram-where-when-replication-occurs.html](https://www.scienceabc.com/pure-sciences/dna-replication-steps-%20%0D%20%20%20%20%20%20%20diagram-where-when-replication-occurs.html)

UNIT II: 1. [https://microbenotes.com/rna-properties-structure-types-and-](https://microbenotes.com/rna-properties-structure-types-and-%20%20%0D%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20functions)

 [functions](https://microbenotes.com/rna-properties-structure-types-and-%20%20%0D%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20functions)

 2. <https://www.britannica.com/science/genetic-code>

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>

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 | Central dogma of life  | 2 | Lecture | PPT |
| 1.2 | DNA structure, types and properties | 3 | Lecture | PPT |
| 1.3 | DNA replication models Theta mode | 3 | Lecture | PPT, Black board |
| 1.4 | DNA replication models – rolling circle model | 3 | Lecture | PPT |
| 1.5 | Mechanism of replication in prokaryotes  | 4 | Lecture | PPT |
| UNIT –II [15 Hrs] |
| 2.1 | RNA structure, types, properties.  | 2 | Lecture | PPT |
| 2.2 | Difference between DNA & RNA | 1 | Lecture | PPT |
| 2.3 | Mechanism of transcription in Prokaryotes | 4 | Lecture | PPT |
| 2.4 | Post transcriptional modification  | 4 | Lecture | PPT |
| 2.4 | Genetic code.  | 4 | Lecture | PPT |
| UNIT – III [15 Hrs] |
| 3.1 | Translation - Mechanism of translation in Prokaryotes  | 4 | Lecture | PPT |
| 3.2 | Post translational modification – transcription coupled translation | 3 | Lecture | Black board |
| 3.3 | Concepts of operons - lac operon and their regulations | 4 | Lecture | Black board |
| 3.4 | Concepts of operons - trp operon and their regulations | 4 | Lecture | PPT |
|  |  |  |  |  |
| UNIT – IV [15 Hrs] |
| 4.1 | DNA as a genetic material - Gene transfer mechanisms  | 2 | Lecture | PPT |
| 4.2 | Transformation – definition, Griffith experiment and Mechanism. | 3 | Lecture | PPT |
| 4.3 | Conjugation - definition, types, F – mediated, | 3 | Lecture | PPT |
| 4.4 | Hfr mediated, F – mediated sexduction. | 3 | Lecture | PPT |
| 4.4 | Transduction - definition, types, and mechanism | 4 | Lecture | PPT |
| UNIT – V [15 Hrs] |
| 5.1 | Mutation – Definition, types, agents – Physical and Chemical. | 5 | Lecture | PPT |
| 5.2 | DNA damage and repair mechanism | 5 | Lecture | PPT |
| 5.3 | Transposons types, structure and Mechanism of transposition  | 5 | Lecture | PPT |

**MAPPING OF COs WITH POs**

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

3 - STRONG 2 - MEDIUM 1 - LOW

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

**Core Lab**  **LAB IN MOLECULAR BIOLOGY** **Code:**

**SEMESTER III**

**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. Induction of beta – galactosidase.
9. 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.

**REFERENCE BOOKS:**

* 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: Mrs. M. SHYAMALA**

**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 BASICS IN BIOTECHNOLOGY Code:**

**Non-Major Elective - I SEMESTER III 2 Hrs/Week**

 **Credits 2**

***PREAMBLE***

* ***This paper introduces the basic fundamentals of Biotechnology and it focuses on the history and future scope of biotechnology.***

**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 scope of Biotechnology and demonstrate the principle design, procedures of Biotechnology laboratory. | K1 |
| **CO 2** | Gain the knowledge on various structural differences between prokaryotic and eukaryotic cells. | K1 and K2  |
| **CO 3** | Identify and understand the principle components of a light microscope and laboratory instruments. | K2 and K3 |
| **CO 4** | Describe the basic structure of Watson and Crick model of DNA and understand the Gene transfer methods. | K2 and K3 |
| **CO 5** | Understand the core concepts of Genetic engineering; analyze the restriction enzymes and vectors for genetic manipulations and fundamentals of plant biotechnology. | K1 and K3 |

K1 - Knowledge K2 - Understanding K3 - Application

UNIT – I: **[5 Hrs]**

 Biotechnology-Histroy, Branches and Scope of Biotechnolgy.Designing of Biotechnology Laboratory.

UNIT – II: **[7 Hrs]**

 Structure of Prokaryotic cell (Bacteria) and Eukaryotic cells (Plant and animal cell) – Difference between Prokaryotic and Eukaryotic cell - T4 Bacteriophage structure.

UNIT – III: **[6 Hrs]**

 Microscopy – Bright field Microscope – Principle and application. Incubator - Laminar air flow, Autoclave and Hot air oven.

UNIT – IV: **[6 Hrs]**

 Central dogma of life, Watson and Crick model of DNA – Structure of RNA, Gene transfer process - Conjucation (F+ x F-).

 UNIT – V: **[6 Hrs]**

Steps involved in genetic Engineering - Type II restriction endonuclease, Ligase enzyme, PBR322 vector. Over view of steps involved in plant tissue culture.

**TEXT BOOKS:**

1. Kumaresan.V., Biotechnology, Saras Publication, Nagarcoil, 2016.
2. PelczarJ.R.,Chan E.C.S., and Krieg R., Microbiology,5th Edition, Tata McGraw-Hill publishing company Limited, Delhi, 2004.

**REFERENCE BOOKS:**

1. Old R.W., Prime Rose S.B., Principles of Gene Manipulation, Blackwell Science.
2. Prescott L.M., Harley J.P., and Klein B.A., Microbiology,6th Edition ,McGraw-Hill Companies, New York,1993.

**Pedagogy:**

chalk and talk

**Web resources: (URLs)**

**Unit I:**<https://www.careerindia.com/courses/unique-courses/what-is-biotechnology-scope-career-opportunities-017583.html>

**Unit II:**<https://www.thoughtco.com/what-are-prokaryotes-and-eukaryotes-129478>

**Unit III:**<https://en.wikipedia.org/wiki/Microscopy>

<http://www.biologydiscussion.com/micro-biology/laboratory-equipment/8-basic-laboratory-equipment-used-in-microbiology-biology/85753>

**Unit IV:**<https://study.com/academy/lesson/watson-crick-model-of-dna.html>

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

<https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/transgenic-plant>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I[5 Hrs] |
| 1.1 | Biotechnology-Histroy | 1 | Lecture | PPT |
| 1.2 | Branches of Biotechnolgy | 1 | Lecture | Black board |
| 1.3 | Scope of Biotechnolgy | 1 | Lecture | PPT |
| 1.4 | Designing of Biotechnology Laboratory  | 2 | Lecture | PPT |
| UNIT –II [7 Hrs] |
| 2.1 | Structure of Prokaryotic cell (Bacteria)  | 2 | Lecture | PPT |
| 2.2 | Eukaryotic cells (Plant and animal cell | 2 | Lecture | PPT |
| 2.3 | Difference between Prokaryotic and Eukaryotic cell | 2 | Lecture | PPT |
| 2.4 | T4 Bacteriophage structure  | 1 | Lecture | PPT |
| UNIT – III [6 Hrs] |
| 3.1 | Microscopy – Bright field Microscope - Principle and application | 2 | Lecture | PPT |
| 3.2 | Principle and application of Incubator  | 1 | Lecture | Black board |
| 3.3 | Principle and application of Laminar air flow, | 1 | Lecture | Black board |
| 3.4 | Principle and application. Incubator - Autoclave and Hot air oven. | 2 | Lecture | PPT |
| UNIT – IV [6 Hrs] |
| 4.1 | Central dogma of life.  | 2 | Lecture | PPT |
| 4.2 | Watson and Crick model of DNA  | 2 | Lecture | Black board |
| 4.3 | Structure of RNA | 1 | Lecture | Black board |
| 4.4 | Gene transfer process - Conjugation (F+ x F-). | 1 | Lecture | Black board |
| UNIT – V [6 Hrs] |
| 5.1 | Steps involved in genetic Engineering - Type II restriction endonuclease,. | 2 | Lecture | Black board |
| 5.2 | Ligase enzyme, PBR322 vector. | 2 | Lecture | PPT |
| 5.3 | Over view of steps involved in plant tissue culture  | 2 | Lecture | PPT |

**MAPPING OF COs WITH POs**

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

**3 - STRONG 2 - MEDIUM 1 – LOW**

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

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

**Skill Based Elective SEMESTER III 2 Hrs/Week**

 **Credits 2**

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

***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 | Down syndrome & 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**

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

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

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

**Core subject IMMUNOLOGY Code –**

 **SEMESTER IV 5 Hrs/Week**

 **Credits 4**

***PREAMBLE***

* **To gain basic knowledge of history and development of immunology.**
* **To understand the importance of antigen and antibody and its structure.**
* **To acquire knowledge on various technique of antigen- antibody interaction.**
* **Exploitation the techniques in immunology through modern trends.**

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**COURSE OUTCOMES (CO)**

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

|  |  |  |
| --- | --- | --- |
|  | **Course Outcome** | **Knowledge Level (According to Bloom’s Taxonomy)** |
| **CO1** | Acquired the knowledge of history and development of immunology. Describe the roles of different types of cells and its activity in immune system. | K1 and K2 |
| **CO2** | Understand to identify the importance of haptens and adjuvants. Explain the structure, properties and functions of Antibiotics |  K2 andK3 |
| **CO3** | Demonstrate and apply the various technique for identifying Antigen and Antibody interaction | K1, K2 and K3 |
| **CO4** | Exemplify the adverse effect of Monoclonal antibody, hypersensitivity and autoimmune diseases | K2 and K3 |
| **CO5** | Recall the success of various methods for the prevention of cancer. Elucidate the reason for immunization and aware of different vaccination |  K2 and K3 |

K1 - Knowledge K2 - Understand K3 - Application

**UNIT – I:** **[15 Hrs]**

History of Immunology: Types of Immunity – Innate and acquired immunity. Cells and Organs involved in immune system – B Lymphocytes, T Lymphocytes, Macrophage, Primary and Secondary lymphoid organs (Thymus, Bone marrow, lymph node and spleen).

**UNIT – II:**  **[15 Hrs]**

Antigens, Haptens and Adjuvants.Antigenicity.Humoral and cell – mediated immunity. Immunoglobulin – Classes, Structure and function. Complements and their role in immunity.

**UNIT – III:**  **[15 Hrs]**

Antigen - antibody interactions. Antibody affinity and avidity.Precipitation reactions-principles, method and types.Agglutination reactions - Hemagglutination and Passive agglutination.Radioimmunoassay, ELISA, Western blotting and Immunoelectrophoresis.

**UNIT – IV:** **[15 Hrs]**

Major Histocompatibility Complex – class I and class II Antigens - Transplantation - Graft rejection, GVH and HVG rejection, HLA tissue typing. Hypersenstivity – Types and Mechanism. Autoimmune disorders – Rheumatoid arthritis and Graves disease.

**UNIT – V: [15 Hrs]**

Hybridoma technology – Monoclonal antibody production - Principles, and its applications. Vaccine – Types and Immunisation Schedule.Tumor antigens and methods for the prevention of cancer.

**TEXT BOOKS:**

1. Donald M. Weir, John Steward. Immunology, 7th Edition. ELBS, London. 1993.
2. Ian Tizzard, Immunology: An Introduction, Saunders College Publishing USA, 1995.
3. Ivan M. Roit. Essential Immunology, Black well Scientific Publications, Oxford. 1994.
4. Richard A. Goldsby, Thomas J. Kindt Barbara A Osborne, Kuby Immunology, 4th Edition, W.H. Freeman and Co. New York, 2000.

**REFERENCE BOOKS:**

* 1. Peter J., Delves. Ivan M. Roit Academic Press, Encyclopaediaof Immunology, 2nd Edition, Academi Press. 1998, USA.
	2. Roitt, J.M., Brostaff, J.J., and Mal, D.K., Immunology, 4th Edition Mosby Publisher C.V., St. Louis. 1996.

**Pedagogy:**

Chalk and Talk

**Web resources: (URLs)**

UNIT I: <https://www.ncbi.nlm.nih.gov/books/NBK279395/>

UNIT II: <https://www.thermofisher.com/in/en/home/life-science/antibodies/antibodies-learning-center/antibodies-resource-library/antibody-methods/immunoglobulin-structure-classes.html>

UNIT III: <https://microbeonline.com/immunology-note/>, <https://microbiologynotes.com/elisa-principle-types-and-applications/>

UNIT IV: <http://njms.rutgers.edu/sgs/olc/mci/prot/2009/Hypersensitivities09.pdf>, <https://gmch.gov.in/e-study/e%20lectures/Microbiology/30%20Immunology%20of%20Transplantation.pdf>

UNIT V: <https://courses.lumenlearning.com/microbiology/chapter/polyclonal-and-monoclonal-antibody-production/>.

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module****No.** | **TOPIC** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| UNIT – I [15 Hrs] |
| 1.1 | History of Immunology  | 2 | Lecture | PPT |
| 1.2 | Types of Immunity – Innate and acquired immunity | 2 | Lecture | PPT |
| 1.3 | Cells and Organs involved in immune system | 3 | Lecture | PPT, Black board |
| 1.4 | B Lymphocytes, T Lymphocytes, Macrophage | 4 | Lecture | PPT |
| 1.5 | Primary and Secondary lymphoid organs (Thymus, Bone marrow, lymph node and spleen). | 4 | Lecture | PPT |
| UNIT –II [15 Hrs] |
| 2.1 | Antigens, Haptens and Adjuvants. Antigenicity | 4 | Lecture | PPT |
| 2.2 | Humoral and cell – mediated immunity. | 4 | Lecture | PPT |
| 2.3 | Immunoglobulin – Classes, Structure and function | 4 | Lecture | PPT |
| 2.4 | Complements and their role in immunity. | 3 | Lecture | PPT |
| UNIT – III [15 Hrs] |
| 3.1 | Antigen - antibody interactions. Antibody affinity and avidity | 4 | Lecture | PPT |
| 3.2 | Precipitation reactions-principles, method and types. | 3 | Lecture | Black board |
| 3.3 | Agglutination reactions - Hemagglutination and Passive agglutination | 4 | Lecture | Black board |
| 3.4 | Radioimmunoassay, ELISA,  | 2 | Lecture | PPT |
| 3.5  | WesternBlotting and Immunoelectrophoresis | 2 | Lecture | PPT |
| UNIT – IV [15 Hrs] |
| 4.1 | Major Histocompatibility Complex – class I and class II Antigens | 4 | Lecture | PPT |
| 4.2 | Transplantation - Graft rejection, GVH and HVG rejection, HLA tissue typing. | 4 | Lecture | PPT |
| 4.3 | Hypersenstivity – Types and Mechanism | 4 | Lecture | PPT |
| 4.4 | Autoimmune disorders – Rheumatoid arthritis and Graves disease  | 3 | Lecture | PPT |
| UNIT – V [15 Hrs] |
| 5.1 | Hybridoma technology – Monoclonal antibody production - Principles, and its applications | 5 | Lecture | PPT |
| 5.2 | Vaccine – Types and Immunisation Schedule | 5 | Lecture | PPT |
| 5.3 | Tumor antigens and methods for the prevention of cancer. | 5 | Lecture | PPT |

**MAPPING OF COs WITH POs**

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

3 - STRONG 2 - MEDIUM 1- LOW

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

**Core Lab LAB IN IMMUNOLOGY Code:**

 **SEMESTER IV 3 Hrs/Week**

 **Credits 3**

***PREAMBLE:***

* ***To count the base line differences and antigen challenges of immunized animals.***
* ***To understand antibody production and antigen – antibody Interaction.***
1. Antigen preparation.
2. Blood Group analysis and Rh determination.
3. Serum and Plasma separation
4. Immunodiffusion
	* 1. Radial immunodiffusion technique.
		2. Ouchterlony double diffusion method.
5. Agglutination reactions –Widal, CRP, HCG.
6. Total WBC count
7. Total RBC count.
8. Differential count of blood.
9. Immuno Electrophoresis
10. Rocket Immunoelectrophoresis.
11. ELISA – Dot Method.
12. Western Blot (Demonstration).
13. Industrial visit.

**TEXT BOOKS:**

1. Hay F.C., and Westwood O.M.R., Practical Immunology, 4th Edition. Blackwell Publishing. 2002, USA.
2. Kanai L. Mukherjee, Medical Laboratory Technology. A procedure manual for routine diagnostic tests Vol I – III, TATA McGraw - Hill Publishing Company Limited, New Delhi, 1998.

 **REFERENCE BOOKS:**

1. Talwar G.P., and Gupta S.K., A Handbook of practical immunology (Vol I and II), Vikas Publishing House Private Limited, New Delhi, 1992.
2. Weis D.M., Hand book of Experimental Immunology, Vol – I to IV Blackwell Scientific Publishers. USA, 1986.

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

**Part – IV APPLIED BIOTECHNOLOGY Code:**

**Non-Major Electives - II SEMESTER IV 2 Hrs/Week**

 **Credits 2**

**PREAMBLE:**

* ***To gain basic knowledge in applied fields like medical, industrial and Environmental biotechnology.***
* ***To understand the applications of Biotechnology in human welfare***

**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 uses of Biotechnology in Agriculture  | K1  |
| **CO 2** | Realize the processes of Biotechnology in cleaning up the environment | K1 and K2  |
| **CO 3** | Appreciate the methods involved in the production of valuable food and other bio-products through biotechnology | K2 and K3 |
| **CO 4** | Explicate the techniques adopted in producing human healthcare products | K2 and K3 |
| **CO 5** | Demonstrate the methods of transgenesis in plants and animals and understanding the patenting & intellectual property rights | K1, K2 and K3 |

**K1 - Knowledge (Remembering) K2 - Understanding K3 - Application**

**UNIT – I:** **[6 Hrs]**

Biotechnology in agriculture- Production and application of Biofertilizers – *Rhizobium* and Vermicompost; Bacterial Pesticide –*Bacillus thuringiensis*.

**UNIT – II:** **[6 Hrs]**

 Biotechnology in environment – Biodegradation of hydrocarbon -Petrol; Biofuel – methane gas production; waste water treatment.

**UNIT – III:** **[6 Hrs]**

 Industrial Biotechnology – Production and application of SCP -

Spirulina; Mushroom production- Oyster mushroom; Wine production.

 **UNIT – IV:** **[6 Hrs]**

 Biotechnology in medicine –Penicillin production; vitamin B12 production, Gene therapy; Vaccine- types and schedule.

 **UNIT – V:** **[6 Hrs]**

 Transgenic animal (Sheep), Transgenic plant (Golden rice) Bio war; Patenting of Biotechnological products, Intellectual Property Rights (IPR)

**TEXT BOOKS:**

1. Dubey R.C., Text Book of Biotechnology, Chand and Chand Publishers, New Delhi.
2. Kumaresan.V., Biotechnology, Saras Publication, Nagarcoil, 2016.

**REFERENCE BOOKS:**

1. David Freifelder, Molecular Biology, 2nd Edition, Narosa Publishing House, New Delhi, 1996.
2. Old R.W., Prime Rose S.B., Principles of Gene Manipulation, Blackwell Science.
3. Standbury P.F., Whitaker and Hall S.J, Principles of Fermentation Technology, Aditya Books (P) Ltd., New Delhi, 2000.

**Pedagogy:**

Chalk and Talk

**Web Resources: (URLs:)**

Unit - I: <https://www.microscopemaster.com/rhizobium.html><https://byjus.com/biology/vermicomposting/>

Unit-II :[https://www.brainkart.com/subject/Environmental- Biotechnology\_242/](https://www.brainkart.com/subject/Environmental-Biotechnology_242/)

 [http://www.suscon.org/pdfs/cowpower/biomethaneSourcebook/Chapte r\_2.pdf](http://www.suscon.org/pdfs/cowpower/biomethaneSourcebook/Chapter_2.pdf)

Unit -III: <https://byjus.com/biology/single-cell-protein/>

 [http://nsdl.niscair.res.in/jspui/bitstream/123456789/599/1/mushroo m%20cultivation%20-%20Formatted.pdf](http://nsdl.niscair.res.in/jspui/bitstream/123456789/599/1/mushroom%20cultivation%20-%20Formatted.pdf)

Unit-IV:

<http://eacharya.inflibnet.ac.in/data-server/eacharya-documents/53e0c6cbe413016f234436f5_INFIEP_17/34/ET/17-34-ET-V1-S1__module_theory_of_penicillin_fermentation.pdf>

 <https://annualmeeting.asgct.org/about_gene_therapy/diseases.php>

 <https://www.vaccines.gov/basics/types>

Unit-V: <https://www.intechopen.com/books/new-visions-in-plant-science/transgenic-plants-gene-constructs-vector-and-transformation-method>

 <https://www.dubaicustoms.gov.ae/en/IPR/Pages/WhatIsIPR.aspx>

**COURSE CONTENTS & TEACHING/LEARNING SCHEDULE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Module No.** | **Topic** | **No. of Lectures** | **Content Delivery Method** | **Teaching Aids** |
| Unit -I [6 Hours] |
| 1.1 | Biotechnology in Agriculture | 1 | Chalk & Talk | Black Board |
| 1.2 | Production and application of Biofertilizers | 1 | Chalk & Talk | Black Board |
| 1.3 | *Rhizobium* and Vermicompost | 2 | Lecture | Power point presentation |
| 1.4 | Bacterial Pesticide –*Bacillus thuringiensis*. | 2 | Chalk & Talk | Black Board |
| Unit - II [6 Hours] |
| 2.1 | Biotechnology in environment  | 1 | Chalk & Talk | Black Board |
| 2.2 | Biodegradation of hydrocarbon -Petrol | 2 | Chalk & Talk | Black Board |
| 2.3 | Biofuel – methane gas production;  | 2 | Lecture | Power point presentation |
| 2.4 | Waste water treatment | 1 | Lecture | Power point presentation |
| Unit - III [6 Hours] |
| 3.1 | Industrial Biotechnology  | 1 | Chalk & Talk | Black Board |
| 3.2 | Production and application of SCP  | 1 | Lecture | Power point presentation |
| 3.3 | Spirulina, Mushroom production | 2 | Chalk & Talk | Black Board |
| 3.4 | Oyster mushroom Wine production | 2 | Lecture | Power point presentation |
| Unit - IV [6 Hours] |
| 4.1 | Biotechnology in medicine  | 1 | Chalk & Talk | Black Board |
| 4.2 | Penicillin production | 1 | Chalk & Talk | Black Board |
| 4.3 | Vitamin B12 production | 1 | Lecture | Power point presentation |
| 4.4 | Gene therapy | 1 | Chalk & Talk | Black Board |
| 4.5 | Vaccine- types and schedule | 2 | Lecture | Power point presentation |
| Unit -V [6 Hours] |
| 5.1 | Transgenic animal (Sheep) | 1 | Lecture | Power point presentation |
| 5.2 | Transgenic plant (Golden rice) Bio war | 2 | Lecture | Power point presentation |
| 5.3 | Patenting of Biotechnological products | 1 | Chalk & Talk | Black Board |
| 5.4 | Intellectual Property Rights (IPR) | 2 | Chalk & Talk | Black Board |

**Mapping of COs with POs**

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

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

**Course Designer : Mr. L. ARUL YESUDOSS**

**Skill Based Elective - IV EVOLUTION Code:**

**SEMESTER IV 2 Hrs/Week**

 **Credits 2**

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

***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 and 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 OF COs WITH POs**

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

3 – STRONG 2 - MEDIUM 1 – LOW

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