

B.Sc Biotechnology

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

1. To make the students competent in the field of biotechnology and its allied areas.
2. To inculcate in the students the capability to work as entrepreneurs and techno managers with strong ethics and communication skills.
3. To equip the students with knowledge and skills enabling them to pursue higher education and research in reputed institutes at the national and international level.
4. To impart a working knowledge of biotechnological products and processes to the students.
5. To aid in understanding the need and impact of biotechnological solutions in the environmental and societal context keeping in view need for sustainable solution.

PROGRAM OUTCOME (PO)

- PO-1 Scientific knowledge: Graduates will acquire biochemistry/biotechnology / bioinformatics/ microbiology specific knowledge including recent techniques in the respective fields coupled with hands-on skills and leadership skills for a successful career.
- PO-2 Problem analysis: Graduates will be able to analyse, solve and troubleshoot problems in implementation of biochemistry/biotechnology/ microbiological protocols.
- PO-3 Design/development of solutions: Graduates will develop creative thinking and cooperate with each other to solve problems in the field of biochemistry/biotechnology/bioinformatics/ microbiology.
- PO-4 Conduct investigations of complex problems: Graduates will acquire practical skills – which help in planning and designing protocols to validate hypothesis and execute experimental techniques independently as well as assimilate, analyse and interpret subsequent data.
- PO-5 Modern tool usage and communication: Graduates will effectively be able to manage resources and time using ICT and computer enabled devices and accomplish ability to understand and communicate all ideas effectively.

PO-6 Environment sustainability and Ethics: Graduates will get adequate knowledge to use information and implement solutions for environmental protection and remediation. Graduates will be aware of their role and responsibility in handling and use of microbes including genetically modified microorganisms.

PO-7 Lifelong learning: Graduates will carry on to learn and adapt in a world of constantly evolving technology.

PROGRAMME SPECIFIC OUTCOME (PSO)

1. Graduates in biotechnology will be eligible for pursuing higher education programmes in the different fields of life science.
2. Graduates will exhibit contemporary knowledge in biotechnology and students will be eligible for taking up jobs in pharmaceutical and biotechnological Industry.
3. Graduates will be able to understand the potential, and impact of biotechnological innovations on environment and their implementation for finding sustainable solution to issues pertaining to environment, health sector, agriculture, etc.
4. Graduates will be able to design, conduct experiments, analyze and interpret data for investigating problems in Biotechnology and allied fields.
5. Graduates will be able to work individually as well as in a team to survive in a multidisciplinary environment.

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES (VISTAS)
B.Sc. BIOTECHNOLOGY DEGREE COURSE
COURSES OF STUDY AND SCHEME OF ASSESSMENT
(CREDITS: 140)

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 1								
LANG	Tamil I/ Hindi / French	5	0	0	5	40	60	100
ENG	English I	5	0	0	5	40	60	100
CORE	Fundamentals of Cell Biology	5	0	0	5	40	60	100
CORE	Basics of Chemistry	4	0	0	4	40	60	100
CORE	PRACTICAL 1 Fundamentals of Cell Biology Practical	0	0	4	2	40	60	100
CORE	PRACTICAL 2 Basics in Chemistry Practical	0	0	4	2	40	60	100
		19	0	8	23			

Programme: B.Sc BIOTECHNOLOGY DEGREE COURSE

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 3								
LANG	Tamil III / Hindi / French	5	0	0	5	40	60	100
ENG	English - III	5	0	0	5	40	60	100
CORE	Clinical Diagnostic Techniques	4	0	0	4	40	60	100
CORE	Principles of Microbiology	4	0	0	4	40	60	100
CORE	PRACTICAL 5 Clinical Diagnostic Techniques Practicals	0	0	4	2	40	60	100
CORE	PRACTICAL 6 Principles of Microbiology Practicals	0	0	4	2	40	60	100
SEC	Soft Skills - I	2	0	0	2	40	60	100
		21	0	8	24			

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Programme: B.Sc BIOTECHNOLOGY DEGREE COURSE

Code No.	Course	Hour / Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 5								
DSE	Genetic Engineering, IPR and Bioethics	6	0	0	6	40	60	100
DSE	Immunotechnology	5	0	0	5	40	60	100
DSE	Biophysics, Biostatistics and Computational Biology	5	0	0	5	40	60	100
DSE	PRACTICAL 8 Genetic Engineering and Immunotechnology Practicals	0	0	4	2	40	60	100
GE	Internet Basics	3	0	0	3	40	60	100
SEC	NSS	2	0	0	2	40	60	100
		21	0	4	23			

Syllabus

Core Courses

FUNDAMENTALS OF CELL BIOLOGY

5 0 0 5

Course Objective:

- To provide knowledge about the morphology, structure and functions of various cells at molecular level.

Course Outcome:

- CO-1: Students understand the molecules of life and how the cell has evolved with period of time.
- CO-2: The structure and functions of cell and the various cell organelles at molecular level are explained in detail.
- CO-3: Student gets to understand the principles of cell division and cell to cell communication.
- CO-4: The progression and role played by oncogenes and tumor suppressor gene in cancer regulation is well covered.
- CO-5: Students learn about the detailed membrane organization and its functions in living cell in transporting material across membrane.
- CO-6: There is a good learning on receptor mediated signal transduction with respect to biomolecules like hormones and other signal molecules.
- CO-7: Students are taught about the basic structures of Proteins and also the various stages of Protein modification and folding for becoming functional.
- CO-8: Students also get to understand the concept of central dogma and genetic code that decides the protein composition finally.
- CO-9: The importance of genetic material, its composition and role in life is well understood.
- CO-10: There is a detailed chapter on anatomy of gene, its repair mechanism and their role in gene regulation.

Unit 1: Cell and Cell Organelles

12

The dynamic cell: Evolution, the molecules of life, the architecture of cells, cells into tissues. Structural organization and function of intracellular organelles: Cell wall, Nucleus, mitochondria, Golgi bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes, Plastids, Vacuoles. Structure and function of Cytoskeleton.

Unit 2: Cell division and Regulation

8

Cell division and cell cycle: Mitosis and Meiosis, their regulation, Tumor cells, Proto-oncogenes and Tumor suppressor genes and their regulation.

Unit 3: Membrane Structure and Function

13

Biomembrane: Structural organization and basic functions. Transport across cell membranes. Cellular energetics: Glycolysis, Aerobic oxidation and Photosynthesis. Microscopy and its type. Cell motility: Microfilaments, Microtubules, Intermediate filaments. Cell - to - Signaling: Hormones and Receptors.

Unit 4: Proteins and its functions

12

Protein structure and function: Hierarchical structure of protein, folding, modification, sorting and degradation of protein, functional design of proteins. Genetic code, Synthesis of proteins.

Unit 5: Molecular Aspects of DNA and RNA**15**

Molecular structure of genes, DNA and chromosomes, Synthesis of DNA and RNA. DNA replication, repair, and recombination, Regulation of transcription Initiation. RNA processing, nuclear transport and post-transcriptional control.

Total : 60 hrs**TEXT BOOKS:**

1. P. K. Gupta, Cell and Molecular Biology, Rastogi Publications. 2012 – 2013.
2. S. C. Rastogi, Cell Biology, New Age International Publishers.2011.
3. NaliniChandar, Susan Viselli, Cell and Molecular Biology, Wolters Kluwer (India) Pvt. Ltd. New Delhi.2012.

REFERENCE BOOKS:

1. Lodish, H. Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D., and Darnell, J. Molecular Cell 3.Biology. Media connected, W. H. Freeman and Company.2000.
2. Cooper, G.M.. The cell. A.S.M press.2000
3. E.D. D. De Robertis, E.M.F. De Robertis, Jr. Cell and Molecular Biology, Wolters Kluwer India Pvt. Ltd.2012.
4. P. S. Verma, V.K. Agarwal. Cytology, S. Chand and Company Pvt. Ltd.,2014.

Course Objective:

- To educate the basics of atoms to chemistry of life.
- To know about chemical use in various industry and its character

Course Outcome:

- CO –1: To learn about chemistry and its classification
- CO –2: To learn about chemical used in industry
- CO –3: To understand the organic chemical and its types
- CO –4: To able to explain chemotherapy concept and it principle
- CO –5: Student know about amino acid and its character
- CO –6: To study about carbohydrate chemistry and its types
- CO –7: Student will have complete knowledge electrochemistry
- CO –8: Student will have idea about chemical analysis using chromatography
- CO –9: To understand the knowledge about the spectrophotometer
- CO –10: To learn about catalyst and its work principle

UNIT 1: Industrial Chemistry

15

Fuels: Fuel gases; Natural gas; water gas - producer gas, Semi-water gas and carbureted gas (composition and uses only) [Manufacturing details not required]

Fertilizers : Preparation and uses of urea, ammonium sulphate, ammonium nitrate, potassium nitrate, super phosphate of lime, triple super phosphate, NPK Fertilizers, and micronutrients

Catalysis: Definition and examples of Acid – base catalysis and enzyme catalysis

Unit 2: Organic compounds

8

Classification of Organic compounds: Functional Groups. Concept IUPAC: System of nomenclature, IUPAC rules for naming alkanes, alkenes, alkynes, alcohols, and aldehydes

Heterocyclic compounds: Synthesis and Chemical properties of furan, thiophenes and pyrrole.

Chemotherapy: Definition and one example each for analgesics, anti-pyretics, local anesthetics, and general anesthetics.

Unit 3: Amino acids and Carbohydrates

13

Amino acids: Classification: general methods of preparation and properties of proteins.

Carbohydrates: Classification, properties and uses of glucose and sucrose.

Unit 4: Electrochemistry

12

Conductors and non-conductors, strong and weak electrolytes common-ion effect, pH, buffer solution. Galvanic cells: emf and its origin, standard electrode potentials, reference electrodes (NHE and calomel), Electrochemical series and its applications

Unit 5: Properties and Physics of biological molecule

12

Spectroscopy: Principle and Applications of UV visible spectroscopy, and infra- red spectroscopy.

Chromatography: Principle, techniques and applications of column, Paper and thin layer Chromatography.

Total : 60 hrs

TEXT BOOKS:

1. Dr.K.Sivakumar, Applied Chemistry.2009.
2. Mr. Bagavathi Sundaram, Applied Chemistry.2006.

REFERENCE BOOKS:

1. Lee, J.D. Inorganic chemistry. Blackwell science.2001.
2. Negi, A.S and Anand. A textbook of physical chemistry. Taj Press. 2001
3. Sony P.L. A textbook Inorganic chemistry, Sultan Chand & sons. 2000
4. Mathews, P. Advanced chemistry. Cambridge university press. Low price edition. 1996
5. Voet D. and Voet J.G. Biochemistry, 2nd edition. John wiley and sons, Inc.1995.
6. Lehninger A.L. Nelson D.L. and Cox, M.M. Principles of Biochemistry 2nd edition. CBS publishers & distributors, Delhi.1993.
7. Amend, J.R. Mundy B.P and Armlid M.T. General, Organic & Biological chemistry. Saunders college publishing.1990.
8. Greenwood, N.N and Earnshaw, A. Chemistry of the elements. Maxwell Macmillan int. Ed.1989
9. Cotton F.A and Wilkinson G. Inorganic chemistry. John wiley and sons, Inc., 1989.
10. Finar, I.L. Organic chemistry Volume 1 & 2, ELBS. 1986.

PRACTICAL I

FUNDAMENTALS OF CELL BIOLOGY PRACTICALS

0 0 4 2

Course Objective:

- To get hands on experience on basic microscopy and its principles and functioning.
- To impart knowledge about various cell organelles and cell division

Course Outcome:

- CO – 1: To understand the basic microbiology handling techniques like sterilization and media preparation.
- CO -2: To learn about staining and slide preparation.
- CO - 3: To be well versed in Basic cell biology practical.
- CO – 4: Student learnt about the practical knowledge of structure and functions of cell and cell organelles at molecular level using microscope.
- CO-5: To learn about different microscope principles
- CO-6: To be well versed with the handling of microscope
- CO-7: Student will understand the cell division principle and its various stages
- CO-8: Student will understand the cell division of gametes production in the organism
- CO-9: Students learn about the presence of Barr body which is otherwise called as sex chromatin. Which they can identify the gender.
- CO – 10: Explore several representative mechanisms underlying key cell-biological functions.

List of Experiments:

1. Sterilization and Media preparation techniques.
2. Different types of Microscope and its principles
3. Electron Microscopy and its principle
4. Mitosis preparation from onion root tip.
5. Meiosis preparation from grasshopper
6. Meiosis preparation from flower bud
7. Buccal smear preparation
8. Charts showing different cell organelles,
9. Charts illustrating the membrane structure -Fluid mosaic model.
10. Charts on Cell cycle- Mitosis and Meiosis.

Total : 36 hrs

PRACTICAL 2 BASICS OF CHEMISTRY PRACTICALS

0 042

Course Objective:

- To provide the basic practical skills of chemical analysis techniques

Course Outcome:

- CO-1: Students will be able to perform volumetric analysis
- CO-2: To be able to perform titration and its calculation
- CO-3: Student can be able to do acidimetric and alkalimetry test
- CO-4: To be able to do permanganometry – dichromometry – iodimetry – complexometry
- CO-5: Student can be able to perform organic compound analysis
- CO-6: To get skills to identify the functional group
- CO-7: Student can be able to perform alcohol analysis
- CO-8: Student will get to know the nitrocompound analysis
- CO-9: To know about aromatic amines and its analysis
- CO-10: Student will have the skill to analyze aromatic ester compounds

List of Experiments:

1. Volumetric analysis:
2. Acidimetric –
3. alkalimetry –
4. permanganometry –
5. dichromometry –
6. iodimetry –
7. complexometry –
8. Analysis of organic compounds with one functional group: aldehyde, ketone, carboxylic acid
9. Analysis of organic compounds with one functional group aromatic primary and secondary amine,
10. Analysis of organic compounds with one functional group phenol, aromatic ester,
11. Analysis of organic compounds with one functional group alcohol,
12. Analysis of organic compounds with one functional group nitro compound, carbohydrate

Total: 45 hrs

MOLECULAR GENETICS AND DEVELOPMENTAL BIOLOGY 5 0 0 5

Course Objective:

- To provide the knowledge from the fundamental aspects of Genetics till the molecular level and significant aspects of developmental biology.

Course Outcome:

- CO-1: Students get an idea on fundamentals of Mendelian and extra chromosomal inheritance with genome organization and related concepts.
- CO-2: There is a brief introduction to the concepts of population genetics.
- CO-3: The students learn about the various types of inheritance such as extra-chromosomal inheritance and sex linked inheritance along with their respective disorders.
- CO-4: The concept and mechanism of Mutation with reference to DNA repair system is taught well.
- CO-5: Students get to understand the major mechanisms involved in gene transfer.
- CO-6: They also learn about the presence and significance of operon models, plasmids and Transposons in the living system.
- CO-7: Students have a good introduction to the concept of Central Dogma and importance of the universal Genetic code and its features.
- CO-8: Get detailed knowledge on transcription, translation and its machinery.
- CO-9: Students are introduced to the different facets of developmental biology.
- CO-10: Study in detail the molecular aspects of embryogenesis in animals and plants.

Unit 1: Principles in Genetics

15

Principles of Mendelian inheritance – Incomplete dominance – Multiple alleles – Linkage, crossing over – Genetic mapping – recombination – Population genetics – Hardy-Weinberg law.

Unit 2: Inheritance of Gene

13

Quantitative genetics – polygenic inheritance – Extra chromosomal inheritance – Sex chromosomes – Sex determination – Sex linked inheritance – Mutation: Types – Mutagens – Ames test for mutagenesis – Chromosomal aberrations – Syndromes – DNA repair.

Unit 3: Gene transfer mechanism

8

Gene Transfer in Bacteria - Conjugation, Transformation, Transduction – operon model in prokaryotic organisms – plasmids - Transposons

Unit 4: Molecular Gene Regulation

12

Transcription – regulation – post transcriptional modification – Genetic code; Translation – regulation – Post translational modification.

Unit 5: Embryo Development

12

Embryology of animals and plants – Morphogenesis; Drosophila – life cycle – embryo development – Molecular aspect of embryogenesis.

Total : 60 hrs

TEXT BOOKS:

1. S. Chand and P.S. Verma, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing. 2006.

2. Dr. Richard Twyman, Instant notes in Developmental Biology, Taylor and Francis, 2000.

REFERENCE BOOKS:

1. Robert J. Brooker, Genetics: Analysis and Principles, 5th edition, McGraw-Hill. 2014
2. Eldon John Gardner, Michael J. Simmons, D. Peter Snustad, Principles of Genetics, 8th edition, John Wiley and Sons. 2012
3. P.S. Varma, B.S. Author Tyagi and V.K. Agarwas, Chordate Embryology, 1st edition, S.Chand and Company. 2006
4. Robert Tamarin, Principles of Genetics, 7th edition, Tata McGraw Hill publishing.2010.
5. Scott F. Gilbert, Developmental Biology, 9th edition. 2010.

BIOCHEMISTRY AND BIO INSTRUMENTATION 4004

Course Objective:

- To provide the basic knowledge about biochemistry to understand the biochemical reactions and principles and importance of various instruments

Course Outcome:

- CO-1: Student will get the basic knowledge and importance about biochemistry
- CO-2: To know about the various biomolecules
- CO-3: Students will understand the biochemical reaction in cells
- CO-4: To learn biosynthesis of molecules
- CO-5: to study about oxidation of biomolecules
- CO-6: To learn basic instruments in biological industries such as microscope and its types
- CO-7: To understand the chromatography techniques to separate products and purification
- CO-8: Student get the basic knowledge about the spectrophotometer
- CO-9: To clearly explains the advanced bioinstrumentation (NMR, FTIR)
- CO-10 To know about XRD and its application in biology

Unit 1: Basics of Life

8

Introduction to Biochemistry. Importance of Biomolecules. Classification of Carbohydrates, Amino acids and lipids.

Unit 2: Biochemical Metabolism

15

Carbohydrate metabolism -Glycolysis, Glycogenesis, Glycogenolysis, Citric acid cycle & HMP shunt. Lipid metabolism- Biosynthesis of Saturated &Unsaturated fattyacids. Beta & omega oxidation of fatty acids and cholesterol Biosynthesis. Amino acids- Essential &Non essential amino acids, structure and properties.

Unit 3: Microscopy and its importance

13

Introduction to Microscopy, History of Microscopy. Principle and applications of Simple, Compound, Phase Contrast, Bright Field, Fluorescent Microscopy, Confocal Microscopy, SEM and TEM.

Unit 4: Separation Techniques

12

Principles and applications of Centrifuge, Chromatography and Elctrophoresis. Various types of Centrifuges, chromatography and electrophoresis. Immunoelectrophoresis and its applications.

Unit 5: Analytical Techniques

12

Principles and applications of different types of spectroscopy. Importance of XRD, FTIR and NMR studies for biological molecules.

Total : 60 hrs

TEXT BOOKS:

1. U. Sathyanarayana, Biochemistry.2012.

REFERENCE BOOKS:

1. U. Sathyanarayana, Chakrapani; Edition 2; Biochemistry- Books and allied (P) Ltd.,2012
2. David L. Nelson, Michael M. Cox,Lehninger Principles of Biochemistry, Publisher: W H Freeman & Co (Sd); 6 Har/Psc edition. 2012
3. **Hiram F. Gilbert, Basic Concepts in Biochemistry: A Students Survival Guide 2nd Edition by World Scientific Publishing Co. Pte. Ltd. 2007.**
4. [M.H Fulekar](#) and [Bhavana Pandey](#),Bioinstrumentation, Publisher: I K International Publishing House, ISBN-13: 978-9382332398. 2013.

PRACTICAL 3 MOLECULAR GENETICS AND DEVELOPMENTAL BIOLOGY PRACTICALS

0 0 4 2

Course Objective:

- To provide the practical knowledge of the fundamental aspects of Genetics till the molecular level and significant aspects of developmental biology.

Course Outcome:

- CO-1:- Students gain practical knowledge about blood group typing and its mechanisms
- CO-2:- To be well versed with the isolation of genomic DNA from the bacteria
- CO-3: To be comfortable with the isolation of genomic DNA from the plants
- CO-4: To be familiar with the isolation of genomic DNA from blood
- CO-5:- Students will get to know Karyotyping and learn to identify the size, shape and number of chromosomes and also helps to learn about the chromosomal aberrations
- CO-6:- To know about the Drosophila culturing strategy.
- CO-7:- To be well versed with the mutation study using Drosophila
- CO-8:- To learn about the chromosome and its isolation from the Chironormous larvae.
- CO-9:- Students get the knowledge about the developmental stages of Chick embryo
- CO-10:- Students can prepare the permanent slide of specimen

List of Experiments:

1. Blood grouping
2. Isolation of genomic DNA from Bacteria
3. Isolation of genomic DNA from plants
4. Isolation of genomic DNA from Blood
5. Karyotyping

6. Preparation of culture medium for *Drosophila*, *Drosophila* culture development and maintenance.
7. Mutation studies of *Drosophila* in Eye
8. Mutation studies of *Drosophila* in Wings
9. Giant chromosome from *Chironormous* larvae
10. Embryo development stages: Different stages of Chick embryo developmental stage 48 hrs, 72 hrs and 96 hrs. (Permanent slide)

Total : 36 hrs

PRACTICAL 4 BIOCHEMISTRY PRACTICAL 0 0 4 2

Course Objective:

- To provide the basic practical skills of biochemical analysis
- To provide skill to operate bioinstruments

Course Outcome:

- CO-1: Students will able to perform carbohydrate estimation
- CO-2: To able estimate amino acids in any samples
- CO-3: To clearly explain about colorimetry work principle
- CO-4: To able to do protein estimation
- CO-5: To get skill to quantify glucose
- CO-6: To understand the titration principle on biochemical analysis
- CO-7: Student can able quantify ascorbic acid in any samples
- CO-8: Student will get to know the chromatography principle
- CO-9: To analyse the amino acid separation using thin layer chromatography
- CO-10: Student will have the skill to analyze data and presentation in biochemistry

List of Experiments:

1. Qualitative estimation of Carbohydrates.
2. Qualitative estimation of amino acids.
Calorimetry
3. Estimation of protein by Lowry's methods.
4. Estimation of glucose by OD method.
Titration
5. Estimation of amino acid by Sorenson formal Titration
6. Estimation of ascorbic acid by Dye method.
Chromatography:
7. Separation of amino acid by Thin Layer Chromatography.

Total: 60 hrs

CLINICAL DIAGNOSIS TECHNIQUES

4 0 0 4

Course Objective:

- To understand fundamental principles and processes used in the clinical laboratory testing and
- To familiarize with the diagnosis of infectious diseases.

Course Outcome:

- CO – 1: To understand the scope and importance of clinical diagnosis
- CO – 2: To learn about the collection, transport and storage of specimen samples
- CO – 3: To understand about the collection of blood and its constituents
- CO – 4: To learn about the blood bank and blood grouping (ABO system & Rh system)
- CO – 5: Student will identify malarial parasites
- CO – 6: Student will learn about the examination method of Urine, sputum, feces, semen and CSF.
- CO – 7: To understand the microbial sensitivity of pathogen present in Urine, sputum and feces.
- CO – 8: To understand various serological tests like Rheumatoid arthritis, Pregnancy test, Widal (slide and tube test), VDRL, HBs antigen, carbohydrate reactive protein test
- CO – 9: To understand the immunological diagnosis of AIDS, MOTT, Legionellosis, Chicken guinea, *Helicobacter pylori* and SARS.
- CO – 10: Student will learn about the clinical manifestation and laboratory diagnosis of bacterial pathogens

Unit1: Clinical Diagnosis

8

Introduction, definition, scope and importance of clinical diagnosis. Specimen –definition, types. Collection and transport of specimen. Specimen preservation and storage.

Unit2: Haematology

15

Blood and its constituents, collection of blood various anticoagulants and their uses. Total Leukocyte Count(TC), Differential count(DC), Erythrocyte Sedimentation Rate(ESR) Red blood cells count(RBC), Platelet count, Packed cell volume(PCV), Mean cell volume(MCV), Hb estimation Bleeding time(BT), Clotting time(CT). Blood bank -Blood grouping(ABO system & Rh system), Identification of malarial *parasites*.

Unit 3: Clinical Pathology

13

Complete urine routine examination –physical, chemical and microbiological examination of urine, Culture and sensitivity. Complete routine examination of sputum and feces. Semen analysis. Examination of CSF.

Unit4: Clinical Serology and Immunology

F

12

Common

serological tests - Rheumatoid arthritis, Pregnancy test, Widal (slide and tube test), VDRL, HBs antigen, carbohydrate reactive protein test. Clinical manifestations and lab immunological diagnosis of AIDS, MOTT, Legionellosis, Chicken guinea, *Helicobacter pylori* and SARS.

Unit5: Clinical Microbiology

12

Clinical manifestation and laboratory diagnosis of bacterial pathogens-Enteric pathogens (*E.coli*, *Shigella*, *Samonella* and *Vibrio*), pyogenic organisms (Staphylococcus and Streptococcus),

Spirochetes (*Leptospira*), Mycobacterium, B. anthracis and Rickettsia. Virology, Mycology and Parasitology - Clinical manifestation and laboratory diagnosis of *Rabies* and *Poliomyelitis*, *Dermatophytes* and *E.histolytica*. Application of nanotechnology in clinical application studies.

Total : 60 hrs

TEXT BOOKS:

1. Pradeepkumar.NS.Manual of Practical Pathology, CBS Publishers and Distributors Pvt Ltd, Chennai. 2011.
2. Naigaonkar.A.V.andM.D.Burande, A Manual of Medical Laboratory Technology, NiraliPrakashan.Pune. 2004

REFERENCE BOOKS:

1. P. Gunasekar, Laboratory Manual in Microbiology, New Age international Private Ltd. Publishers, New Delhi, Chennai.1995.
2. Prakash M & C.K. Arora, Biochemical techniques, Anmol publication (1) Ltd New Delhi.1998.
3. David T. Plummer, An Introduction to practical biochemistry – 3rd edition. Tata McGraw Hill Publishing Company Ltd New Delhi. 1978
4. Lele Buckingham and Maribeth L. Flaws,Molecular Diagnostics: Fundamentals, Methods & Clinical applications. 2007.
5. Lewin .B Genes VIII, Oxford University Press. 2004.
6. Lewontin and W.M. Gelbart,Modern Genetic Analysis, W.H. Freeman, New York.1999
7. Watson J.D. Tania A baker, Stephen P. Bell, Alexander,Molecular Biology of the Gene. 2004
8. David E. Bruns, Edward R. Ashwood, Carl A. Burtis.Fundamentals of Molecular Diagnostics. Saunders Group. 2007
9. Expert Review of Proteomics and Molecular Diagnostics (Journals) 2011.
10. Watson, J.D. Tania A baker, Stephen P.Bell, Alexander Gann, Michael Levine, Richard Losick, Molecular Biology of the Gene.Pearson Education Pte. Ltd. (Singapore). 2004
11. G. M. Malacinski and D. Friefelder,Essentials of Molecular Biology,Jones& Bartlett publishers. 1998
12. Government of India, Ministry of Science and Technology, Dept.of Biotechnology, Recombinant DNA safety guidelines New Delhi. 1990.
13. Rudin,N and Inman, K.An Introduction to Forensic DNA Analysis. CRC Press.2002.
14. Forensic DNA Typing. Biology, Technology and Genetics of STR markers 2005.
15. Molecular Diagnostics edited by George Patrinos, Wilhelm Ansorge.2009.

PRINCIPLES OF MICROBIOLOGY

4 0 0 4

Course Objective:

- To provide the knowledge about various microbes and their structure, function
- The uses of microbes in various industries.

Course Outcome:

- CO – 1: Student will learn about the History and scope of microbiology and its classification and taxonomy
- CO – 2: Student will learn about the identify microorganism by Morphology, biochemical and molecular techniques.
- CO – 3: Student will learn about various types of microorganisms like Viruses, Protozoa, Bacteria, Fungi and Algae.
- CO – 4: To understand the structure and function of cellular components of each microorganism
- CO – 5: To understand the Microbial ecosystems and biogeochemical cycles
- CO – 6: Student will learn about various food borne pathogens and find the method to preserve the food
- CO – 7: Student will learn about microbial pathogens which causes disease
- CO – 8: Student will study the various control and prevention measure to kill microbial pathogens
- CO – 9: Student will learn about beneficial microorganism used in various industries
- CO –10: To understand and benefit of beneficial microbes in Dairy, beverages, biofertilizers, Biopesticide etc.

Unit 1: History

9

Introduction to Microbiology - History and scope of Microbiology - Classification of microbes – Numerical taxonomy – Molecular taxonomy – Methods of Microbial identification.

Unit 2: Various microbes

9

Structure and function of the Cellular Components – Viruses, Protozoa, Bacteria, Fungi and Algae.

Unit 3: Microbes in environment

15

Environmental Microbiology - Introduction to microbial ecosystems and biogeochemical cycles (global geochemical cycling of elements). Food Microbiology - Food borne infections and

intoxications; bacterial with examples of infective and toxic types – *Clostridium*, *Salmonella*, *Staphylococcus*. Food preservation methods

Unit 4: Microbial diseases**12**

Medical microbiology – Pathogenic microbes – Bacterial, Viral, Fungal and Protozoan Diseases. Cure, control and prevention – Pharmaceuticals (antibiotics, vaccines, etc.)

Unit 5: Industrial uses of microbe**15**

Industrial uses of microbes —Dairy and non Dairy products- fermented foods, production of food (Single cell protein) and alcoholic beverages –, Fuel (ethanol). Methanogenesis - methane production. Biofertilizers (BGA), Biopesticide (*Bacillus thuringiensis*), Biopolymers, Biosurfactants.

Total : 60 hrs**TEXT BOOKS:**

1. Ananthanarayan, R and Paniker, C.K.J. A textbook of microbiology. 7th edition. Orient Longman Ltd. 2005.
2. Parija S.C, Textbook of Microbiology & Immunology, Elsevier, India.2009

REFERENCE BOOKS:

1. Pelczar M.J, Chan ECS, King NR, McGraw – Hill, Inc.NY. Microbiology- Concepts and Applications. Tata Mac. Graw Hill.2001
2. Ananthanarayan, R and Paniker, C.K.J. A textbook of microbiology. 7th edition. Orient Longman Ltd. 2005
3. Pelzar. Microbiology, 5th edition. Tata Mac Graw Hill.2000
4. Ingraham, J.L. and C.A. Ingraham, Introduction to microbiology, 2nd edition. Brooks/Cole, Thomson Learning, USA.2000.
5. Kathleen Park Talaro and Talaro, A. Foundation in microbiology, 3rd edition. Mac Graw – Hill.1999.
6. Cappucino, J.G and Sharman, N. Microbiology: A laboratory manual, 4th edition. Additional Wesley Longbman, Incorporation.1999.
7. Prescott LM, Harley JP, Klein's DA. Microbiology, 6th edition, McGraw-Hill Higher Education.2005.
8. Shimled L.A. and A.T. Rodgers, Essential of diagnostic microbiology. Delmar Cengage Learning publishers.1999.
9. Prescott,s, Linda Sherwood, Joanne Willey, Chris Woolverton, Micro Biology 9 th edition Publisher: The McGraw-Hill Company.2013

PRACTICAL 5

CLINICAL DIAGNOSTIC TECHNIQUES PRACTICALS

0042

Course Objective:

- To understand fundamental practical principles and processes used in the clinical laboratory testing
- To familiarize with the diagnosis techniques of infectious diseases.

Course Outcome:

- CO – 1: Student will learn about significance of Hemoglobin
- CO – 2: To estimate the RBC, WBC, Platelets
- CO – 3: To understand the Blood grouping and Rh system
- CO – 4: To estimate the Sugar level in human blood
- CO – 5: To understand the amount of cholesterol in human blood
- CO – 6: To Know the function of Blood coagulation cascade
- CO – 7: To understand the Red blood cell Sedimentation time
- CO – 8: Constitutions of White blood cells
- CO – 9: Student will learn about the of Nature of urine sample
- CO – 10: Microscopic Analysis of urine sample

List of Experiments:

1. Blood analysis I: Estimation of Haemoglobin by Haemometer
2. Estimation of RBC by Haemocytometer
3. Estimation of WBC by Haemocytometer
4. ABO Blood Grouping and Rh factor
5. Blood sugar analysis by Follin Wu Method
6. Blood cholesterol analysis
7. Blood analysis II: Total leukocyte count and Differential count
8. Erythrocyte Sedimentation Rate
9. Bleeding time and Clotting time
10. Urine analysis : Color reaction, pH,
11. Albumin and Sugar of Urine Sample

Analysis of urine deposits (pus cells, Epithelia cells, RBC's and crystals) using microscope

Total : 36 hrs

PRACTICAL 6

PRINCIPLES OF MICROBIOLOGY PRACTICALS

0042

Course Objective:

- To provide the practical knowledge about various microbiology techniques

Course Outcome:

- CO – 1: To understand the importance and principle of sterilization
- CO – 2: Student will learn about isolation of microorganisms
- CO – 3: To understand the Population of microbial cultures
- CO – 4: To observe the structure of microbes
- CO – 5: To understand the motility of Bacteria
- CO – 6: To identify the Gram positive and Gram negative Bacteria
- CO – 7: To understand the spore structure of bacteria
- CO – 8: To differentiate the capsule formed in bacteria
- CO – 9: Student will learn about the of Biochemical identification
- CO – 10: To know the culture characteristic of bacteria

List of Experiments:

1. Sterilization techniques
2. Pour plate and Spread plate
3. Dilution techniques
4. Wet Mount preparation: Hay infusion, hanging drop.
5. Simple staining
6. Gram's staining
7. Capsule staining
8. Spore staining
9. Catalase test
10. Oxidase test
11. Urease test
12. IMVIC test

Total : 45 hrs

PLANT AND ANIMAL BIOTECHNOLOGY 4004

Course Objective:

- The objective of this course is to introduce students to learn basics in Plant and Animal Biotechnology
- To know about the application in improvement of crops and livestock.

Course Outcome:

- CO –1: Student will understand about plant genome organization and gene families
- CO –2: Student will have knowledge on plant hormones, gene expressions
- CO –3: To understand the subject of plant genetic engineering
- CO–4: student will understand the various techniques and vector involved in plant transformation
- CO –5: student will learn about the GM crops and their products
- CO –6: Understanding the knowledge of improvement of crops and yields
- CO –7: To understand the term of molecular farming, plant tissue culture, embryogenesis and protoplast culture
- CO –8: Student will learn about the embryo transferring in animals
- CO –9: To learn about various gene transfer methods in animals
- CO –10: Student will learn about genetically modified animals and artificial insemination of animals
- CO –11: To understand about the animal cell culture and origin and characterization of various cell lines

Unit 1: Plant Genetics and Physiology

8

Plant genome organization, Gene families in plants. Chloroplast and Mitochondrial genome. Plant hormones- structure and function regulation of gene expression. IAA, GA, Cytokinins, ABA and Ethylene.

Unit 2: Plant Molecular Biology

15

Genetic engineering of plants. Vectors for plant transformation. Techniques for Plant transformation. Genetic manipulation for herbicide, disease and stress resistance. Transgenic crops- concerns about GM crops and products. Introduction to inducible gene expression.

Unit 3: Crop Improvement

12

Improvement of crop yield and quality. Molecular farming / pharming. Plant tissue culture, Micro propagation, Cell suspension culture, Somatic embryogenesis, Anther culture. Protoplast culture and its applications.

Unit 4: Embryo transfer mechanism

13

In vitro fertilization and embryo transfer in animals. Cryopreservation in vitro fertilization & technique of embryo transfer, super ovulation and embryo culture. Gene Transfer methods in animals- Microinjection, Embryonic stem cell gene transfer, Retro Virus Gene Transfer.

Unit 5: Genetically modified animals

12

Transgenic animal's sheep, pigs, goats, cows. Artificial insemination animal clones. Animal cells primary cell culture, differentiation of cells, animal cell lines under origin and characterization.

Total : 60 hrs

TEXT BOOKS:

1. Animal Biotechnology, M.M Ranga Third Edition, Agro Bios, India. 2007.
2. Ignacimuthu, Applied Plant Biotechnology. Tata McGraw Hill. 1996

3. Rajagopal, K., Kathiravan, G. and Karthikeyan; S. Introduction to Plant Biotechnology. DGI, publishers. Chennai. 2014.
4. H.S.Chawla, Plant Biotechnology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi. 2004.

REFERENCE BOOKS:

1. Animal biotechnology: Models in discovery and Translation, Ashish S Verma, Anchal Singh, Academic Press. 2014
2. Animal biotechnology, Editors- A.K Srivastava, R.K Singh, M.P Yadav , Oxford and IBH publishing company PVT LTD.2009
3. Animal biotechnology, Manjula Shenoy, Laxmi Publications PVT LTD. 2007.
4. Introduction to Animal Biotechnology, Ravi Pathak , Atlantic publishers and distributors PVT LTD. 2007.
5. Introduction to plant biotechnology, H.S Chawla Third Edition, Science Publishers, 2009
6. Plant Biotechnology, Slater Ascot N Fowler M, Oxford University Press.2003.
7. Introduction to Plant Cell Tissue and Organ Culture, Sumil D Purohit PHI Learning PVT LTD.2013.
8. Adrian Slater, N.Scott and Mark Fowler. Plant Biotechnology. Oxford University press. 2003.

TEXT BOOKS:

1. Gupta.S.K, 2007, Basic Principles of Clinical Research and Methodology.

REFERENCE BOOKS:

1. Textbook of Therapeutics Drug and Disease management Eric T. Herfindel, Dick R. Gourley. 6th edition.
2. Assuring data quality and validity in clinical trials for regulatory decision making: Janet woodcock, Frederick Ognibene, John Overbeke 2003.
3. Medical transcription guide: do's and don'ts- Marilyn takahashi Fortney Otis Diehl.

BIOPHYSICS, BIOSTATISTICS & COMPUTATIONAL BIOLOGY 4004

Course Objective:

- It provides detail knowledge about basic principles in biophysics, data collection and analysis,
- To know the importance of computational biology for biologists.

Course Outcome:

- CO –1: Student will understand about biostatistics
- CO –2: To understand about collection and calculation measures of central tendency
- Student will understand various statistical methods
- CO –3: To understand about Baye's theorem, errors and tests
- CO –4: Understand the methods of Biophysis and structure of protein and stability
- CO –5: Student will understand the various bonding and structure properties of water
- CO –6: Students will knowledge about the classification and conformation of proteins
- CO –7: Student will understand various types of protein structures and Ramachandran plot
- CO –8: To understand about the fundamentals of bioinformatics
- CO –9: To understand the biological Database
- CO –10: To Know the sequence Alignment tool.

Unit 1: Basics of Biostatistics

8

Introduction to biostatistics - Collection, Classification, Tabulation, Diagrammatic representation. Measures of Central Tendency.

Unit 2: Different statistical methods

12

Measures of Dispersion, Correlation, Regression Lines. Probability, Conditional Probability, Baye's theorem, sampling theory and errors. Tests of significance. T, Chi square and F-test.

Unit 3: Biophysics of molecules

15

Scope and methods of Biophysics. Various bonding: structure and properties of water. Understanding various structure of proteins, globular and fibrous protein; protein stability; protein folding. The physics of nucleic acids: Forces stabilizing structures; Double helical structures; properties; helix – coil; transitions.

Unit 4: Conformation of structures

12

Biophysics: Introduction to biophysics, classification and conformation of proteins primary, secondary, tertiary and quaternary structure, Ramachandran plot.

Unit 5: Fundamentals of bioinformatics

13

Definition, nucleic acid and protein sequence database, sequence analysis, sequence alignment hidden mark, types of alignment, BLAST, FASTA, inter pro-log models.

Total : 60 hrs

TEXT BOOKS:

1. Thiravia Raj, Biophysics. 2004.
2. Sai Subramanian, Biostatistics. 2005.
3. Thiagarajan. B, Computational Biology. 2009

REFERENCE BOOKS:

1. P. Narayanan, Essentials of Biophysics ISBN-13: 978-8122420807 , 2008
2. William Bialek. Biophysics: Searching for Principles: ISBN-13: 978-0691138916: ISBN-10: 0691138915, Princeton University Press. 2012
3. Philip Nelson, Biological Physics: with New Art by David Goodsell ISBN-13: 978-0716798972 ISBN-10: 0716798972, 2013
4. Gupta S.P., Sultan Chand & Sons, Statistical Methods: ISBN 978-93-5161-028-1, 2014
5. Zhumur Ghosh, Bibekanand Mallick. Bioinformatics: Principles & Applications Oxford University Press. 2008

PRACTICAL 7 PLANT & ANIMAL BIOTECHNOLOGY PRACTICALS 0042

Course Objective:

- Learn basics practical knowledge in Plant and Animal Biotechnology

Course Outcome:

- CO –1: To learn about the Hardening of Plants
- CO –2: To know about the callus formation in plant tissue culture
- CO –3: To understand the process involved in protoplasmic fusion
- CO –4: To learn about how to handle an animal
- CO –5: Know to handle the animal cell culture techniques
- CO –6: To learn the regeneration of plants in tissue culture
- CO –7: To understand the cytological examination
- CO –8: To know the nature of cell line cultures
- CO –9: Handling of cell line cultures
- CO –10: To gain information on stem cell Technology

List of Experiments:

1. Learn about Plant Tissue Culture Lab infrastructure, Green House Hardening Lab.
2. Preparation of media, Sterilization of media, glassware, hormones, etc.
3. Inoculation of explants for callus formation seed, bud, embryo, anther, leaf tissue.
4. Cytological examination of callus tissue.
5. Protoplast isolation.
6. Animal House infrastructure and Animal Handling.

7. Preparation of media, Sterilization of glassware, media and other accessories for animal cell culture.
8. Isolation of cells and cell viability study.
9. Monolayer formation.
10. Stem cell isolation (Demo).

Total : 45 hrs

Syllabus
Discipline Specific Elective Courses

GENETIC ENGINEERING, IPR AND BIOETHICS 6 0 0 6

Course Objective:

- To understand vector biology, principles in cloning, cloning strategies for prokaryotes and eukaryotes,
- To know about the molecular techniques and ethical issues.

Course Outcome:

- CO –1: To learn about the fundamental principles of cloning vectors
- CO –2: Student will understand about the gene markers
- CO –3: To understand about various types of vector
- CO –4: Student will understand about cloning of *Saccharomyces cerevisiae*
- CO –5: Student will have complete knowledge about various molecular techniques and their application
- CO –6: Student will have complete knowledge about DNA sequencing and fingerprinting
- CO –7: Student will have idea about Gene transfer technologies and analysis
- CO –8: To understand the knowledge about the Agriculture and Forensic science
- CO –9: Student will have knowledge about Intellectual property rights and Patents
- CO –10: To understand the importance and release of GMOs organisms and foods

Unit 1: Vector Biology

8

Fundamental principles of cloning vectors – Plasmid biology: E.coli vectors- pBR322 and its derivatives- Phage- Filamentous phages – Cosmid – Phagemid – Gene markers.

Unit 2: Types of vector

12

Eukaryotic vectors – Cloning in *Saccharomyces cerevisiae*: Types of vectors- Animal cell cloning vectors and Plant cloning vectors.

Unit 3: Molecular techniques

15

Electrophoresis of DNA – blotting techniques - molecular probes – Hybridization techniques - Autoradiography – Restriction Fragment Length Polymorphism (RFLP) - DNA fingerprinting - . Polymerase chain reaction (PCR) - Random amplification of polymorphic DNA (RAPD) – DNA sequencing. Real time –PCR.

Unit 4: Gene transfer and its significance

12

Gene transfer technologies - Gene Cloning and DNA analysis in Medicine, Agriculture and Forensic science.

Unit 5: IPR and its importance

13

Intellectual Property Rights(IPR) and patents, Biosafety, containment facilities for Genetic Engineering experiments, Release of GMOs (Genetically Modified Organisms), labeling of GM (Genetically Modified) Foods.

Total : 60 hrs

TEXT BOOKS:

1. Vadakar Praveen. Concepts, Theories and Practice of Human Rights, Raja Publications. 2000
2. Mishra Promod, Human Rights Global Issues, Kalpaz Publications. 2000
3. B.D. Singh, 2005, Molecular biology and Genetic Engineering, Kalyani publishers.2005
4. T.A.Brown, Gene cloning and DNA analysis, 6th edition, Wiley Blackwell science.2010.

REFERENCE BOOKS:

1. Watson, Molecular Biology of the gene, 5th edition Person education, Singapore. 2004
2. Kreuzer-Massey, Recombinant DNA and Biotechnology, ASM Press. 2001
3. Alcamo, I. Edward. DNA Technology, Academic Press.2001
4. Traylor, P.C., Frederick, R. and Koch M. Biosafety. Board of Trustees, Michigan State University, USA. 2002.
5. Paul, R.C. Situations of Human Rights in India, Efficient Offset printers.2000
6. Jecker Nancy.S *et al.* Bioethics: An Introduction to the History, Methods and practice,Jones and Bartlett.2010
7. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 4th edition. 2006

IMMUNOTECHNOLOGY

5 0 0 5

Course Objective:

- To provide basic knowledge of immunology for biotechnologists and their application in modern medical field.

Course Outcome:

- CO-1: Students will learn about basic immune system
- CO-2: To know various types of antigen
- CO-3: Student will understand the isolation, purification and characterization techniques for the antigens.
- CO-4: To learn about isolation of various types of immune cells.
- CO-5: To get basic knowledge about antibodies
- CO-6: Student can able to explain the monoclonal antibodies.
- CO-7: To learn about hypersensitivity, cell characterization and HLA typing.
- CO-8: To know about cytokines and its types
- CO-9: To understand the vaccine and its types
- CO-10: To know about various iques for infectious diseases

Unit 1:Types of Immunity

10

Immunity: Humoral and Cell mediated immunity – Antigen, Hapten, Immunoglobulins – structure and types- Immune cells and organs.

Unit 2: Immune cells

12

Purification of mononuclear cells from peripheral blood: Isolation and characterization of T cells subsets; B cells, dendrite cells and Macrophages; Macrophage cultures; Assay for Macrophage activation.

Unit 3:Antibodies

15

Production of antibodies - Hybridoma and Monoclonal antibody production – Immunodiagnostic and Application of Monoclonal antibodies in biomedical research - Purification of antibodies - Quantization of immunoglobulin's.

Unit 4:Immune Response

13

Hypersensitivity: Assessment of delayed type hypersensitivity reactions; Immunohistopathological studies and detection of immune complexes - HLA typing – Immunogenomics – Antibody diversity.

Unit 5: Cytokines and Vaccines

13

Biology & Assay of cytokines; Vaccine technology including DNA vaccine: Immunotechnology and Infectious diseases.

Total: 60 hrs

TEXT BOOKS:

1. Fahim Halim Khan, 2009. The elements of Immunology. Dorling Kindersley (India) Pvt. Ltd, Pearson Education India.
2. SeemiFarhatBasir, 2009. Textbook of Immunology. PHI Learning Private limited, New Delhi.

REFERENCE BOOKS:

1. Ramasamy, P. & R.E.B. Hanna, Immunity and Inflammation. University of Madras Publication Division, M/s. Pearl press, Chennai, India. 2002.
2. Parslow, T.G., Stites, D.P. and Terr, A.L. Medical Immunology, 10th edition. McGraw-Hill publishing. 2001
3. Goldsby, R.A., Kindt, T.J. and Osborne, B.A. Kuby Immunology. 4th edition. Freeman and company. 2000.
4. Zola, H. Monoclonal antibodies. Bios Scientific Publishers ltd. 2000.
5. Roitt, Immunology. Blackwell scientific Publications. 1996
6. Ivan Roitt, Essential Immunology, 10th Edn. Blackwell Scientific Publication.2002
7. Weir DM and Stewart, J., Immunology, 10th Edn. Churchill Livingston, New York.2000
8. BruceAlberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts and James D Watson, Molecular Biology of the Cell (5th Edn).2000.
9. Ivan Roitt, Jonathan Brostoff, David Male, 2002, Immunology, 5th Edn., Mosby Publication.2002.
10. Kuby, J. 2002, Immunology. W.H. Freeman and Company, New York.2002.
11. Abul K. Abbas, Andrew K. Lichtman& Jordan S. Pober, 2001, Cellular and Molecular Immunology. 3rd Edn. W.B. Saunders Company. 2001

PRACTICAL 8

GENETIC ENGINEERING AND IMMUNOTECHNOLOGY PRACTICALS

0042

Course Objective:

- To provide the basic practical skills of genetic engineering techniques

Course Outcome:

- CO-1: Students will be able to culture bacteria with antibiotic selection and isolate genomic and plasmid DNA from the cells
- CO-2: Students will be able to isolate RNA from the cells
- CO-3: Students will be able to operate agarose gel electrophoresis
- CO-4: Student will be able to Quantify nucleic acids, perform restriction digestion of DNA and ligation of DNA
- CO-5: Student will be able to prepare competent cells and perform transformation in bacteria
- CO-6: Student will be able to perform various immuno diffusion methods and immunoelectrophoresis.
- CO-7: Student can be able to perform ASO test, RPR test and Widal test
- CO-8: Student can be able to make perform blood grouping and get to know the Rh factor
- CO-9: Students can be able to know about ELISA technique concept and perform the techniques
- CO-10: To know about PCR concept and perform the techniques

List of Experiments:

1. Isolation of genomic DNA
2. Preparation of Bacterial cell culture, antibiotic selection media and isolation of plasmid DNA
3. Agarose gel electrophoresis
4. Quantification of DNA and RNA
5. Competent cell preparation and Transformation
6. Restriction digestion and Ligation
7. PCR – DEMO
8. Single and Double immuno diffusion
9. Immunoelectrophoresis
10. ASO test
11. RPR test
12. Widal test
13. Blood grouping and Rh typing
14. DOT ELISA- DEMO

Total: 45 hrs

MICROBIAL AND ENVIRONMENTAL BIOTECHNOLOGY 5005

Course Objective:

- To provide the basic knowledge of industrial products from microorganisms and use of microorganisms in cleaning of environment.

Course Outcome:

- CO-1: Students will have the knowledge on basics of microbial biotechnology
- CO-2: To be well versed with fermentation principles
- CO-3: To be well versed with various microbial products.
- CO-4: To gain knowledge of production methods of enzymes, organic solvents, yeast and milk products.
- CO-5: Provides knowledge about basic terminologies used in environmental biotechnology.
- CO-6: To clearly know about biopesticides and biofertilizers
- CO-7: students will get the knowledge about bioremediation
- CO-8: To understand the concept of microbe to clean up the polluted environment, mining, etc.
- CO-9: Students will be familiar with Denitrification process
- CO-10: To clearly explain the concept of Methanogenesis

Unit 1: Introduction to Microbial Biotechnology

10

History and scope of microbial biotechnology, microbial diversity and its use, cultivation and preservation of microorganisms in small scale. Microbial polysaccharides, immobilized cells.

Unit 2: Microbial Products

12

Production of microbial enzymes and applications, production of organic solvents, single cell proteins, production of beverages, Production of baker's yeast, milk products. Microbes in mining. Production of biofertilizers, biopesticides and their application. Bioenergy and biomass.

Unit 3: Basics of Environmental Biotechnology

13

Concept and scope of environmental biotechnology. Bioconversion, bioaccumulation, biomagnifications. Bioremediation, biofeasibility, application of bioremediation, bioreduction, phytoremediation.

Unit 4: Microbial Functions

15

Bioabsorption and bioleaching of heavy metals: Metal – microbial interactions, commercial biosorbents, bioleaching. Advantages and disadvantages of bioleaching. Solid waste pollution and its managements, biomedical waste management, biodegradation of pollutants by microorganisms.

Unit 5: Denitrification and Methanogenesis

10

Denitrification: physiology of denitrifying bacteria – tertiary denitrification – one sludge denitrification – drinking water treatment, anaerobic treatment by methanogenesis, uses for methanogenic treatment.

Total : 60 hrs

TEXT BOOKS:

1. Bimal C. Bhattachayya, Rintu Banerje, Environmental Biotechnology, Oxford University Press. 2010.
2. Padma Singh. Recent Trends in Microbial Biotechnology. CBS Publishers and Distributors. 2013

REFERENCE BOOKS:

1. El-man, E.M.T and Bryce, C.F.A. Fermentation microbiology and Biotechnology. Taylor and Francis group. 2002
2. Prave, P. Faust, V. Sitting W and sukatesh O, A. (Ed). Fundamentals of Biotechnology. WCH Weinhein. 1987
3. Patel.A.H, Industrial Microbiology, MacMillan India, Ltd. 1996
4. Wulfrueger and Anneliese Cruerher, A Text Book of industrial Microbiology, Paima Publishing Corporation, New Delhi. 2000.
5. Ram Kumar, Environmental Biodegradation, Sarup/sons. 2000.
6. Bruce E. Rittmann, Perry L. McCarty, Environmental Biotechnology – Principle and Application, Tata McGraw Hill Education Pvt.Ltd. 2012.
7. Alexander N. Glazer and Hiroshi Nikaido, Microbial Biotechnology. Fundamentals of Applied Microbiology. Cambridge Publications. 2007.

BIOFERMENTATION AND DOWNSTREAM PROCESSING

6004

Course Objective:

- To make the students familiar with the theoretical aspects of Biofermentation and Downstream Processing for biotechnology industries.

Course Outcome:

- CO-1: Students will have knowledge on basics of fermentation principles
- CO-2: To learn upstream process in fermentation
- CO-3: Students can able to formulate fermentation media for fermentation
- CO-4: To know the various sterilization method in the industries
- CO-5: To know the procedure to operate fermenter for various fermentation processes.
- CO-6: To know about various type of Fermentor/reactor
- CO-7: Student can able to design reactor.
- CO-8: Students will learn about various downstream processing.
- CO-9: To know about various types of chromatography concepts and its types
- CO-10: To understand and importance of finished product state

Unit 1:Basics of Fermentation Technology**10**

Introduction to Fermentation technology, History of Fermentation, Basic principles in Fermentation process - Media formulation, Sterilization-Batch and continuous sterilization systems.

Unit 2:Fermentation Processes**15**

Introduction to Fermentation processes- microbial culture selection for fermentation processes; main parameters to be monitored and controlled in fermentation processes, aerobic and anaerobic fermentation processes and their applications in the Fermentation industry.

Unit 3:Bioreactors and Types**12**

Bioreactors: Design, function and their parts. Continuous and fed batch cultures, Different types of reactors- packed bed reactor, fluidized bed reactor, trickle bed reactor and bubble column reactor.

Unit 4:Downstream Processing I**13**

Introduction to Downstream processing principles-Recovery of particulate matter, product isolation, Precipitation, filtration, centrifugation, liquid -liquid extraction, aqueous two phase extraction, solvent extraction, membrane separation- Ultra filtration, reverse osmosis and dialysis.

Unit 5:Downstream Processing II**10**

Product purification- chromatography- adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction and affinity chromatographic techniques. Crystallization, drying and lyophilisation.

Total hrs : 60**TEXT BOOKS:**

1. A.H.Patel. Industrial Microbiology. Macmillan India Limited. New Delhi.2005.
2. L.E.Casida, JR. Industrial Microbiology. New Age International Publisher. New Delhi. 2007.

REFERENCE BOOKS:

1. P.F.Stanbury, A.Whitaker and S.J.Hall..Principles of Fermentation Technology 2ndedition.Elsevir Science Limited.2012
2. MichealJ.Waites.Neil. Morgan, John S.Rockey and Gary Higton..Industrial Microbiology.Blackwell Science Publisher.United Kingdom. 2001
3. Michael Shuler and Kargi. Bioprocess Engineering Basic concepts. 2ndedition.Pearson Prentice Hall of Private Limited, India. 2006
4. Prescott and Dunn. Industrial microbiology.4th edition. CBS Publishers and Distributors Private Limited, New Delhi.2004

PHARMACEUTICAL BIOTECHNOLOGY 6004

Course Objective:

- To provide knowledge on principles of drug development, design and its importance in Pharmaceutical industry.

Course Outcome:

- CO – 1: To know about Principle of pharmacology
- CO-2: To get basic knowledge about Drugs, its names and classification
- CO – 3: To clearly know about different therapeutic types
- CO-4: Study about genetic engineering in Pharmaceuticals
- CO-5: To clearly explain about rDNA technology pharmaceutical products
- CO-6: To be well versed in actions of different drug compounds
- CO-7: To clearly explain about the bioactivity of various careers
- CO-8: To clearly understand the concept of chemotherapy
- CO-9: To know about biomaterials used in pharmacy
- CO-10: To be well versed with the protein engineering concept

Unit 1: Basics of Pharmacology

10

History and Principle of pharmacology. Drug names and Classification systems. General Principles of Drug action Pharmacokinetics, Pharmacodynamics.

Unit 2: Drug Treatment

12

Chemotherapeutic drugs- Protein synthesis inhibitors, Antimycobacterial, anti-fungal, anti-protozoal, antiviral, anticancer, anti-inflammatory drugs.

Unit 3: r-DNA Technology

15

Techniques of r-DNA technology for production of Bio active compounds - Human Insulin, Human Growth Hormone

Unit 4: Drug Compounds

13

Production of Ergot alkaloids, Probiotics, Production of recombinant vaccines. Anticancer agents and anti-inflammatory agents in chemotherapy.

Unit 5: Bioactivity

10

Biochips, Biofilms, Biosurfactants, Biorepellents and Protein Engineering.

Total hrs : 60

TEXT BOOKS:

1. Sivakumar.S M, Pharmaceutical Biotechnology. 2003
2. Sambamurthy.K, Pharmaceutical Biotechnology. 2006

REFERENCE BOOKS:

1. Pharmaceutical Biotechnology (PB) Vyas S.P. / Dixit V. ISBN : 9788123906140, 2011
2. Walsh, Biopharmaceuticals: Biochemistry and Biotechnology, 2e (PB) ISBN : 9788126530014, 2011
3. S.S. Agrawal and M. Paridhavi, Herbal Drug Technology, University press 2007.
4. O. Kayser, R.H. Muller. Pharmaceutical Biotechnology - Drug Discovery and clinical applications. Wiley - VCH. 2004

BIOPHYSICS, BIOSTATISTICS & COMPUTATIONAL BIOLOGY 4 0 0 4

Course Objective:

- It provides detail knowledge about basic principles in biophysics, data collection and analysis,
- To know the importance of computational biology for biologists.

Course Outcome:

- CO –1: Student will understand about biostatistics
- CO –2: To understand about collection and calculation measures of central tendency
- Student will understand various statistical methods
- CO –3: To understand about Baye's theorem, errors and tests
- CO –4: Understand the methods of Biophysics and structure of protein and stability
- CO –5: Student will understand the various bonding and structure properties of water
- CO –6: Students will knowledge about the classification and conformation of proteins
- CO –7: Student will understand various types of protein structures and Ramachandran plot
- CO –8: To understand about the fundamentals of bioinformatics
- CO –9: To understand the biological Database
- CO –10: To Know the sequence Alignment tool.

Unit 1: Basics of Biostatistics

8

Introduction to biostatistics - Collection, Classification, Tabulation, Diagrammatic representation. Measures of Central Tendency.

Unit 2: Different statistical methods

12

Measures of Dispersion, Correlation, Regression Lines. Probability, Conditional Probability, Baye's theorem, sampling theory and errors. Tests of significance. T, Chi square and F-test.

Unit 3: Biophysics of molecules**15**

Scope and methods of Biophysics. Various bonding: structure and properties of water. Understanding various structure of proteins, globular and fibrous protein; protein stability; protein folding. The physics of nucleic acids: Forces stabilizing structures; Double helical structures; properties; helix – coil; transitions.

Unit 4: Conformation of structures**12**

Biophysics: Introduction to biophysics, classification and conformation of proteins primary, secondary, tertiary and quaternary structure, Ramachandran plot.

Unit 5: Fundamentals of bioinformatics**13**

Definition, nucleic acid and protein sequence database, sequence analysis, sequence alignment hidden mark, types of alignment, BLAST, FASTA, inter pro-log models.

Total : 60 hrs**TEXT BOOKS:**

4. Thiravia Raj, Biophysics. 2004.
5. Sai Subramanian, Biostatistics. 2005.
6. Thiagarajan. B, Computational Biology. 2009

REFERENCE BOOKS:

6. P. Narayanan, Essentials of Biophysics ISBN-13: 978-8122420807 , 2008
7. William Bialek. Biophysics: Searching for Principles: ISBN-13: 978-0691138916: ISBN-10: 0691138915, Princeton University Press. 2012
8. Philip Nelson, Biological Physics: with New Art by David Goodsell ISBN-13: 978-0716798972 ISBN-10: 0716798972, 2013
9. Gupta S.P., Sultan Chand & Sons, Statistical Methods: ISBN 978-93-5161-028-1, 2014
10. Zhumur Ghosh, Bibekanand Mallick. Bioinformatics: Principles & Applications Oxford University Press. 2008

Syllabus
Skill Enhancement Courses

SOFT SKILL I

Unit I Reading Comprehension and Vocabulary 08

Definitions of reading – types of reading – oral reading – silent reading – reading process – classification of reading – nature of reading – Filling in the blanks – Cloze Exercises – Vocabulary building – Reading and answering question.

Unit II Listening and Answering Question 08

Listening process – speaker – hearer – types of listening – transitional listening – critical listening – recreational listening – listening for appreciation – selective listening – intensive listening- extensive listening – listening and sequencing sentences – filling in the blanks – listening and answering questions.

Unit III Group Discussion 08

Introduction – Why GD Part of a selection process – Structure of a GD-Strategies in GD – Team work – body language – Debating various points of views – interaction with peers.

Unit IV Conversations 08

Introducing oneself and others, narrating events – making telephonic conversation – Giving instruction – Giving instruction- Expressing purposes and functions- obligation and preferences, Accepting offers and Counseling Face to face Conversations

Unit V Self – Introduction and Role Play 08

Introduction self and greetings- asking for information- offerings- requisitions- inviting – vocabulary building- asking for description.

Total: 40 hrs

Text Books:

1. Barun K. Mitra, “Personality Development and Soft Skills”. Oxford University Press. New Delhi. 2011.
2. S.P. Sharma, “Personalilty Development”, Pustaq Mahal. New Delhi. 2010.

Reference Books:

1. Meenakshi Raman and Sangeetha Sharma, “Technical Communication”, Oxford University Press. New Delhi, 2009. A.S. Hornby: “Oxford Advanced Learner’s Dictionary of Current English”, Oxford University Press, 2007

SOFT SKILL II

Unit I Presentation Skills

08

General presentation methods and developing presentation skill

Unit II Soft skills (Time Management, Stress Management and Body Language)

08

Time management: Importance, Plan and Execution, Default reason and rectification methods. Stress Management: Stress Impacts over Efficiency and how to manage. Body Language: Its importance and need

Unit III Resume / Report / Letter Writing

08

Resume: Basic components of a resume, Preparation of a resume, Types of resume Report: How to prepare reports, reports components and structure Letter writing: types of letters, framing letters, basic structure, how to draft a letter

Unit IV Frequently asked Questions

08

Unit V Interview Skills

08

Aims of Interview expectations and how to fulfill, developing skills

Total: 40 hrs

1. Barun K. Mitra, "Personality Development and Soft Skills". Oxford University Press. New Delhi. 2011.
2. S.P. Sharma, "Personality Development", Pustaq Mahal. New Delhi. 2010.

Reference Books:

1. Meenakshi Raman and Sangeetha Sharma, "Technical Communication", Oxford University Press. New Delhi, 2009.
2. A.S. Hornby: "Oxford Advanced Learner's Dictionary of Current English" Oxford University Press, 2007

NSS SYLLABUS FOR HONOURS/PASS/GENERAL COURSES

PAPER-01

No. of Lectures (35)

- Unit - 01: Introduction and Basic Concepts of NSS (4)**
- a) History, philosophy, aims & objectives of NSS (1)
 - b) Emblem, flag, motto, song, badge etc. (1)
 - c) Organizational structure, roles and responsibilities of various NSS functionaries (2)
- Unit - 02: NSS Programmes and Activities (10)**
- a) Concept of regular activities, special camping, Day Camps (3)
 - b) Basis of adoption of village/slums, Methodology of conducting Survey (2)
 - c) Financial pattern of the scheme (1)
 - d) Other youth prog./schemes of GOI (2)
 - e) Coordination with different agencies (1)
 - f) Maintenance of the Diary (1)
- Unit - 03: Understanding Youth (5)**
- a) Definition, profile of youth, categories of youth (2)
 - b) Issues, challenges and opportunities for youth (2)
 - c) Youth as an agent of social change (1)
- Unit - 04: Community Mobilisation (9)**
- a) Mapping of community stakeholders (3)
 - b) Designing the message in the context of the problem and the culture of the community (1)
 - c) Identifying methods of mobilisation (3)
 - d) Youth-adult partnership (2)
- Unit - 05: Volunteerism and Shramdan (7)**
- a) Indian Tradition of volunteerism (1)
 - b) Needs & importance of volunteerism (2)
 - c) Motivation and Constraints of Volunteerism (2)
 - d) Shramdan as a part of volunteerism (2)

Project work/Practical

40 Marks

Syllabus
Ability Enhancement Compulsory Courses

ENGLISH- I

-5 0 0 5

COURSE OBJECTIVE:

- To enable students to develop their communication skills effectively. To make students familiar with the English Language.
- To enrich their vocabulary in English
- To develop communicative competency

	Credit Hours
UNIT I - Preparatory Lesson	12
1. Competition Matters Suzanne Sievert	
2. A Personal Crisis May Change History Dr. A.P.J. Abdul Kalam	
3. Why Preserve Biodiversity Prof. D. Balasubramanian	
UNIT II –Prose	12
1. The Unexpected Robert Lynd	
2. My Greatest Olympic Prize Jesse Owens	
3. If You are wrong, admit it Dale Carnegie	
UNIT III –Poetry	12
1. The Night of the Scorpion Nissim Ezekiel	
2. Pulley or The Gift of God George Herbert	
3. La Bella Dame Sans Merci John Keats	
UNIT IV- Short Story	12
1. The Gift of Magi O Henry	
2. Three Questions Leo Tolstoy	
UNIT V – One Act Play	12
1. The Shirt Francis Dilion	
2. The Pie and the Tart Hugh Chesterman	
	Total: 60 Hours

Books Prescribed:

- Confluence - Anu Chithra Publications

ENGLISH- II

-5 0 0 5

COURSE OBJECTIVE:

- To enable students to develop their communication skills effectively
- To make students familiar with various sentence patterns of the English Language
- To enrich their vocabulary in English
- To develop communicative competency

	Credit Hours
UNIT-I Prose	12
1. The Words of Wisdom Chetan Bhagat	
2. Forgetting Robert Lynd	
3. My Early Days Dr. A.P.J. Abdul Kalam	
UNIT II –Poetry	12
1. Ozymandias Percy Bysshe Shelley	
2. Mending Wall Robert Frost	
3. Where the Mind is Without Fear Rabindranath Tagore	
UNIT III –Short Story	12
1. Am I Blue? Alice Walker	
2. The Last Leaf O’ Henry	
3. The Selfish Giant Oscar Wilde	
UNIT IV – One Act Play	12
1. Soul Gone Home Langston Hughes	
UNIT V	12
1. Lexical Skills	
2. Vocabulary	
3. Communication and Grammar at the end of all lessons	

Total: 60 Hours

Books Prescribed:

Radiance - Emerald Publications

COURSE OBJECTIVE:

- To train students in the use of English language in varied literary and non-literary context
- To teach them soft skills and strengthen their foundation in grammar and composition -
To evaluate their comprehension skills.

Credit Hours**UNIT - I- Prose****12**

- 1. Two Gentleman of Verona - A.J. Cronin
- 2. Judas Iscariot - Bonnie Chamberlain
- 3. Dangers of Drug Abuse - J. V. S. Henbane

UNIT II - Short Stories**12**

- 1. Journey by Night - Norah Burke
- 2. The 2000-Mile Turtle - Henry Edward Fox
- 3. Fools Paradise - Isaac Bashevis Singer

UNIT III – Fiction**12**

- 1. R. L. Stevenson - Dr. Jekyll & Mr. Hyde (Retold by Kennet) – S.
Chand & company Ltd.

UNIT IV - Functional English**12**

- 1. Paragraph Writing
- 2. Comprehension
- 3. Letter Writing
- 4. Report writing
 - a News Paper Report
 - b Reports for Government Official Attention
 - c Definition

UNIT V – Conversation In Situations & Conversation Practice**12****1. Conversation in Situations**

- a) At the Airport
- b) In a Bank
- c) On the Beach
- d) At the Customs
- e) At the Doctors'
- f) In a Flight
- g) In a Hotel
- h) In a Restaurant
- i) In a Shop
- j) Tea Time
- k) On the Telephone
- l) In a Travel Agency
- m) On a Country Walk
- n) At the theatre

o) In a Street

2. Conversation Practice

a) Daily Activities

b) Asking Directions

c) Travel plans

d) Living in an Apartment

e) Money Problems

f) Weather Conditions

g) Dinner Conversations

h) Common Health Problems

i) Tag Questions

j) Office Conversations

3. Expansion of Hints

Total: 60 Hours

Books Prescribed:

1. Effective English Communications for You – V. Syamala, Emerald Publishers, Chennai.
2. English Conversation Practice by D. H. Spencer, Oxford University Press
3. English Conversation Practice by Grant Taylor, Tata McCraw-Hill, Publishing Company Limited, New Delhi.

ENGLISH – IV**-5 0 0 5**

- To train students in the use of English language in varied literary and non-literary context - To teach them soft skills and strength their foundation in grammar and composition - To elevate their comprehension skills.

	Credit Hours
UNIT I – Prose	12
1.Walking Tours - R. L. Stevenson	
2.All About a Dog - A. G. Gardinar	
3.No Man is an Island - Minno Masani	
UNIT II - Short Stories	12
1. The Man Who Likes Dickens - Evelyn Waugh	
2. Lamb to the Slaughter - Roald Dahl	
3. Buck Hears the Call - Jack London	
UNIT III – Drama	12
1.Selected Scenes from Shakespeare’s Plays – Book I, Emerald Publishers	
a) Funeral Oration (Julius Caesar)	
b) Trial for a Pound of Flesh (The Merchant of Venice)	
c) Patterns of Love (As You Like It)	
UNIT IV	12
1. General Essay Writing & Group Discussion	
2. Persuasive Writing and Role Play	
UNIT V	12
1.Notice, Agenda, Minutes.	

Total: 60 Hours**Books Prescribed:**

1.Invitation to English Prose – A. E. Varadarajan & S. Jagadisan, Ori

FRENCH I

5 0 0 45

Course Objective:

- To introduce French Language. To enable the students to understand and to acquire the basic knowledge of French, Language with the elementary grammar.

UNIT 1 : INTRODUCTION

12

Introduction - Alphabet – Comment prononcer, écrire et lire les mots- Base : Les prénoms personnel de 1^{er}, 2^{ème} et 3^{ème} personnes – Conjugaisons les verbes être et avoir en forme affirmative, négative et interrogative

UNIT 2 : Leçons 1- 3

12

Leçons 1.Premiers mots en français,- 2. Les hommes sont difficiles,- 3 Vive la liberté- Réponses aux questions tirés de la leçon - Grammaire : Les adjectives masculines ou féminines – Les articles définis et indéfinis - Singuliers et pluriels

UNIT 3 :Leçons 4- 6 12

Leçons 4. L'heure, C'est 1 heure,- 5. Elle va revoir sa Normandie,- 6 .Mettez –vous d'accord groupe de nom - Réponses aux questions tirés de la leçon - Grammaire :Aplacer et accorder l'adjectif en groupe de nom- Préposition de lieu –A écrire les nombres et l'heure en français

UNIT 4 : Leçons 7- 9

12

Leçons7. Trois visage de l'aventure,- 8. A moi, Auvergne,- 9. Recit de voyage - Réponses aux questions tirés de la leçon - Grammaire : Adjectif possessif – Les Phrases au Présent de l'indicatif - Les phrases avec les verbes pronominaux au présent

UNIT 5 : Composition :

12

Aécrire une lettre à un ami l'invitant à une célébration différente ex : mariage – A faire le dialogue - A lire le passage et répondre aux questions

Total : 60 hrs

TEXT BOOK :

Jacky GIRARDER & Jean Marie GRIDLIG,« Méthode de Français, PANORAMA », Clé Internationale , Goyal Publication, New Delhi., Edition 2004

REFERENCE BOOKS:

1. DONDO Mathurin , “ Modern French Course”, Oxford University Press., New Delhi., Edition 1997
2. Nitya Vijayakumar, “Get Ready French Grammar – Elementary”,Goyal Publications, New Delhi., Edition 2010

FRENCH II

5 0 0 5

Course Objective:

- To fortify the grammar and vocabulary skills of the students. Enable the students have an idea of the French Culture and Civilization

UNIT 1 :Leçons 10 – 11

12

Leçons : 10. Les affaires marchent,- 11. Un après midi à problèmes- Réponses, aux questions tirés de la leçon - Grammaire : Présent progressif, passé récent ou future proche - Complément d'objet directe - Complément d'objet, indirecte.

UNIT 2 : Leçons 12– 13

12

Leçons : 12. Tout est bien qui fini bien,- 13. Aux armes citoyens –Réponses, aux questions tirés de la leçon - Grammaire :Les pronoms« en ou y » rapporter des paroles - Les pronoms relatifs que, qui, ou où ,

UNIT 3 : Leçons 14– 15

12

Leçons 14. Qui ne risqué rien n'a rien,- 15. La fortune sourit aux audacieux – Réponses aux questions tirés de la leçon - Grammaire : Comparaison– Les phrases au passé composé

UNIT 4 : Leçons 16 – 18

12

Leçons16 La publicite et nos rêves 17 La France le monde 18 Campagne publicitaire Réponses aux questions tirés de la leçon - Grammaire :- Les phrases à l' Imparfait - Les phrases au Future

UNIT 5 : Composition :

12

A écrire une lettre de regret// refus à un ami concernant l'invitation d'une, célébration reçue- A écrire un essai sur un sujet générale - A lire le passage et répondre aux questions

TOTAL : 60 hrs

TEXT BOOK

Jacky GIRARDER & Jean Marie GRIDLIG,« Méthode de Français, PANORAMA », Clé Internationale , Goyal Publication, New Delhi.,Edition 2004

REFERENCE BOOKS

1. DONDO Mathurin, “ Modern French Course”, Oxford University Press, New Delhi., Edition 1997
2. Paul Chinnappane “ Grammaire Française Facile” , Saraswathi House Pvt, Ltd, New Delhi, Edition 2010

FRENCH III

5 0 0 5

Course Objective:

- To strengthen the Grammar and Composition in French language. To train the students to enhance his skill in French language for communication

UNIT 1 : LEÇONS 16& 29

12

La famille Vincent (Page 44) - Grammaire : Passé composé'Vers l'hôtel (page 80) Grammaire : Impératif, A mettre les phrases, du singulier au pluriel

UNIT 2 :LEÇONS 40 & 44

12

L'épicerie, les légumes et les fruits (page 112) – Grammaire : Présent, de l'indicatif a poste (page 124) – 1 Grammaire : A mettre les phrases à l'imparfait

UNIT 3 : LEÇONS 51 & 58

12

Le café et tabac (page 142) - Grammaire : A changer les phrases en Interrogatif, La Chasse et la pêche (160) - Grammaire : Le plus que parfait

UNIT 4 : LEÇONS 61

12

Un mariage à la campagne(page 170) - Grammaire –A changer au participe présent

UNIT 5 : COMPOSITION

12

Aécrire une lettre à un ami l'invitant à une celebration differente ex : mariage – A faire un essaie sur un sujet générale - A lire le passage et répondre aux questions

TOTAL : 60 hrs

TEXTBOOK :

Les leçons ont été choisi et tiré de I & II degré de G .MAUGER « Cours de, Langue et de Civilisation Française » The Millenium,Publication Hachette,Edition 2002

REFERENCE BOOKS:

1. DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi., Edition 1997
2. Paul Chinnapan, « Saraswati Grammaire Française facile », Saraswathi House, Pvt. Ltd., New Delhi., Edition 2010
3. Larouse, "Larouse French Grammar",Goyal Publication, New Delhi, Edition, 1995.

FRENCH IV

5 0 0 5

Course Objective:

- To enable the students to strengthen their knowledge of grammar/composition
- To make the students to develop their skills of communication in French language

UNIT I LEÇONS 20& 46

12

Une grande Nouvelle (page 56) – Grammaire : A mettre les phrases au Future, Le métro ; l'autobus (page 130) -Grammaire :A former ou à changer, l'adjectif masculin ou féminin à l'adverbe - Atrouver les noms qui correspondent aux verbes.

UNIT II LEÇONS 48 &63

12

A la Préfecture de police (page 132) - Grammaire : Les Pronoms relatifs, Les sports (page 174)
Grammaire : Le conditionnel présent

UNIT III LEÇONS 56 &57

12

A Biarritz, la plage (page 156) - Grammaire : Le future antérieure, Dans les Pyrénées (page 158)
-Grammaire : Le future antérieure suite)

UNIT IV LEÇONS 65

12

A fin des vacances (page 178) Grammaire : A changer les phrases du pluriel, au singulier - Le présent du subjonctif

UNIT V COMPOSITION

12

A écrire une lettre de regret / refus à un ami concernant l'invitation d'une célébration reçue- A écrire un essai sur un sujet générale - A lire le passage et répondre aux questions

TOTAL : 60 hrs

TEXTBOOK :

Les leçons ont été choisis et tirés de I & II degré de G .MAUGER « Cours de, Langue et de Civilisation Française » The Millennium,Publication Hachette,Édition 2002

REFERENCE BOOKS:

1. DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi., Edition 1997
2. Paul Chinnapan, « Saraswati Grammaire Française facile », Saraswathi House, Pvt. Ltd., New Delhi., Edition 2010
3. Larousse, "Larousse French Grammar",Goyal Publication, New Delhi, Edition, 1995.

HINDI I

5 0 0 5

Course Objective:

- To train the students in the use of Karyalayin Basha. To enable the students to develop the communication skill in Hindi language .

Unit 1: Gadya aur Karyalayin Basha

Mamata, -Yogyatha evam vyavasay kaa ChunaavParibashik shabdavalil prashasanik vakyansh,padanam, 12

Unit 2:Gadya aur Sarkari Patra

Rajneethi kaa Bhantwara, , Samanya sarkari patra,gyapan,karyalay gyapan 12

Unit 3: Gadya aur Sarkari Patra

Computer nayi krantee kee dastak, , Karyalay aadesh,Ardha sarkari patraparipatra,Adhisoochana 12

Unit 4 :Gadya aur Samanya Patra

Raspriya, Samanya patra- chutti patra,sampadak ke naam patra, shikayati patra, pustak vikretha ke naam patra 12

Unit 5:Vyavasaayik patra

Bankon mein bach khaata kholne ke liye – chek buk ke liye, run lene hetu, chek buk gum ho jane hetu, kitaabon kaa krayadesh 12

Total : 60 hrs

TEXT BOOK:

Gadya Aur Prayojanmulak Hindi ed by Dr.N.Lavanya Mayura Publishers,edition 2008

HINDI II

5 0 0 5

Course Objective:

- To enable the students to have the knowledge in contemporary literature of the modern era. It also provides an idea how translation to be effected.

Unit 1: Kahani Aur Ekanki

Poos Kee Raat.,- Duzhazar 12

Unit 2:Ekanki aur Kahani

Vaapasi,Akeli, .Akbhari vigyapan 12

Unit 3 : Kahani Aur Anuvad

Sharandatha -Anuvad anuched angreji se hindi me karne ke liye. 12

Unit 4:Ekanki aur Anuvad

Raat ke Raahi Main Bhi Maanav hoonAnuvad anuched angreji se hindi me karne ke liye. 12

Unit 5:Kahani,Ekanki Aur Anuvad

Parda -Yeh Meri Janma Bhoomi Hai -anuvad anuched angreji se hindi me karne ke liye. 12

Total : 60 hrs

TEXT BOOK:

Sankalan Kahani evam Ekankied by Dr.N.Lavanya, Mayura Publishers,edition 2010

Course Objective:

- To help the students to have in depth knowledge of Literature. It makes the students to acquire more about the medieval period through the literary works.

Unit 1:Prachin Kavya Hindi Sahitya ka Itihas

Kabir- Hindi bash aka vikas – Hindi sahitya kaa aavirbahv

12**Unit 2:Prachin Kavya Hindi Sahitya ka Itihas**

Surdaas, Tulsidass. Hindi sahitya kaa kaal vibhajan, aadikal, kaa Parichay

12**Unit 3:Prachin Kavya Hindi Sahitya ka Itihas**

Rahim, aadikaal kaa namkran, paristhitiyan, racha evam rachnaakar

12**Unit 4: Bhakti Kaal, Reethi kaa**

Bhakti kal kaa vibhajan paristhitiyan- racha evam rachnaakar - Reethikal ke prakaar, rachna evam rachnakar

12**Unit 5:Prachin Kavya evam rachnakaron kaa parichay**

Bihari -Chandbardayee, Ameerkhusaro, Kabir, Surdas, Tulsidas Jaayasi, Kesahv das Bhushan,

Total : 60 hrs**TEXT BOOK:**

Prachin evam Aadhunik Kavya Sankalan ed by Dr.N.Lavanya, Mayura Publishers, Edition 2011

REFERENCE BOOK:

Hindi Sahitya kaa Itihas, By Dr.Nagendra, Raj kamal Prakashan, 1997

HINDI IV

5 0 0 5

Course Objective:

- To enable the students to acquire knowledge in journalism so as to enhance his skill in effective communication pertaining to Hindi language.

Unit 1:Aadhunik kavitha Aur Rachnaakar

Mythili Sharan Gupt - Apna Sansar, Aadhunik Rachnakar Hazaari prasad Diwedi, Mahaveer Prasad Diwedi, **12**

Unit 2:Aadhunik kavitha Aur Rachnaakar

Jayashankar Prasad Kamayani - Chinta, Aadhunik Hindi Rachanakar Premchand, Jainendra **12**

Unit 3:Aadhunik kavitha Aur Patrakaritha

Mahadeviverma, Murjaya PhoolBhavani Prasad Mishra Patrakarita – paribhasha,, arth, prakar, swaroop **12**

Unit 4:Aadhunik kavitha , Patrakaritha aur Rachnakar

Mukthibodh Tum Logoan se door, Shamsheer Bhadur Singh – Bharat kee aarathi, Vigyapan-sampadan kala,-Nirala, -Pant- Mohan Rakesh **12**

Unit 5: Aadhunik kavitha , Patrakaritha aur Rachnakar

Prabhakar Machve Nimna Mdhya varg, **Patrakaritha-** samachar sankalan - Peeth patrakarita, Rachnakaar - Fanishwaranath renu -Mannu bhandari, Bhagawaticharan Verma, Yashpal **12**

Total : 60 hrs

TEXT BOOK:

Prachin evam Aadhunik Kavya Sankalan ed by Dr.N.Lavanya, Mayura Publishers, edition 2011

REFERENCE BOOK:

Patrakaritha Ek Paricahy by Dr.Madhu Dhawan, Bodh Prakashan, edition 1997

தமிழ் மொழி, இலக்கிய வரலாறு – அறிமுகம்5005

நோக்கம்: தமிழ்மொழி மற்றும் இலக்கியத்தின் வரலாற்றை அறிமுகம் செய்யும் நோக்கில் இப்பாடம் வடிவமைக்கப்பட்டுள்ளது. தமிழ்மொழியின் வரலாற்றை அறிவியல் கண்ணோட்டத்துடனும் மொழிக்குடும்பங்களின் அடிப்படையிலும் விளக்குகிறது. சங்க இலக்கியம் தொடங்கி, இக்கால இலக்கியம் வரையிலான தமிழிலக்கிய வரலாற்றை இலக்கிய வரலாறு அறிமுகப்படுத்துகின்றது. அரசு வேலை வாய்ப்பிற்கான போட்டித் தேர்வுகளுக்குப் பயன்படும் வகையிலும் இப்பாடம் அமைந்துள்ளது.

அலகு 1 தமிழ் மொழி வரலாறு

13

மொழிக்குடும்பம் - இந்திய மொழிக்குடும்பங்கள் - இந்திய ஆட்சி மொழிகள் - திராவிட மொழிக்குடும்பங்கள் - திராவிட மொழிகளின் வகைகள் - திராவிட மொழிகளின் சிறப்புகள் - திராவிட மொழிகளின் வழங்கிடங்கள் - திராவிட மொழிகளுள் தமிழின் இடம் - தமிழ்மொழியின் சிறப்புகள் - தமிழ் பிறமொழித் தொடர்புகள்.

அலகு 2 சங்க இலக்கியம்

12

சங்க இலக்கியம் - எட்டுத்தொகை - நற்றிணை - குறுந்தொகை - ஐங்குறுநூறு - பதிற்றுப்பத்து - பரிபாடல் - கலித்தொகை - அகநானூறு - புறநானூறு - பத்துப்பாட்டு - திருமுருகாற்றுப்படை - சிறுபாணாற்றுப்படை - பெரும்பாணாற்றுப்படை - பொருநராற்றுப்படை - மலைபடுகடாம் - குறிஞ்சிப்பாட்டு, முல்லைப்பாட்டு, பட்டினப்பாலை - நெடுநல்வாடை - மதுரைக்காஞ்சி.

அலகு 3 அற இலக்கியங்களும் காப்பியங்களும்

11

களப்பிரர் காலம் விளக்கம் - நீதி இலக்கியத்தின் சமூகத்தேவை - பதினெண்கீழ்க்கணக்கு நூல்கள் அறிமுகம் - திருக்குறள், நாலடியார்.

காப்பியங்கள் - ஐம்பெருங்காப்பியங்கள் மற்றும் ஐஞ்சிறுங்காப்பியங்கள் அறிமுகம்-காப்பிய இலக்கணம் - சிலப்பதிகாரம் - மணிமேகலை - சீவகசிந்தாமணி - வளையாபதி - குண்டலகேசி.

அலகு 4 பக்தி இலக்கியங்களும் சிற்றிலக்கியங்களும்

11

தமிழகப் பக்தி இயக்கங்கள் - பக்தி இலக்கியங்கள் - சைவ இலக்கியம் - நாயன்மார்கள் அறுபத்து மூவர் - சமயக்குரவர் நால்வர் - வைணவ இலக்கியம் - பன்னிரு ஆழ்வார்கள் - முதல் மூன்று ஆழ்வார்கள்.

சிற்றிலக்கியக் காலம் - சிற்றிலக்கியங்கள் - வகைகள் - பரணி - கலிங்கத்துப்பரணி - குறவஞ்சி - குற்றாலக் குறவஞ்சி - பிள்ளைத்தமிழ் - மீனாட்சியம்மைப் பிள்ளைத்தமிழ் - தூது - தமிழ்விடு தூது - கலம்பகம் - நந்திக்கலம்பகம் - பள்ளு - முக்கூடற்பள்ளு.

அலகு 5 இக்கால இலக்கியங்கள்

13

நவீன காலம் - நவீன இலக்கியம் - உள்ளடக்கம் - புதுக்கவிதை - தோற்றமும் வளர்ச்சியும் - நாவல் - முதல் மூன்று நாவல்கள் - நாவலின் வகைகள் - பொழுது போக்கு நாவல்கள் - வரலாற்று நாவல்கள் - சமூக நாவல்கள் - இக்கால நாவல்கள் - மொழிபெயர்ப்பு நாவல்கள் - சிறுகதை - வகைகளும் வளர்ச்சியும் - நாடகம் - காலந்தோறும் நாடகங்கள் - புராண இதிகாச நாடகங்கள் - சமூக நாடகங்கள் - வரலாற்று நாடகங்கள் - மொழிபெயர்ப்பு நாடகங்கள் - நகைச்சுவை நாடகங்கள்.

மொத்தம்: 60 மணி நேரம்

பார்வை நூல்கள்

1. அகத்தியலிங்கம். ச., "திராவிடமொழிகள் தொகுதி 1", மணிவாசகர் பதிப்பகம், முதற்பதிப்பு, 1978.
2. சக்திவேல். ச., "தமிழ்மொழி வரலாறு", மணிவாசகர் பதிப்பகம், முதற்பதிப்பு 1998.
3. பூவண்ணன், "தமிழ் இலக்கிய வரலாறு", சைவசித்தாந்த நூற்பதிப்புக் கழகம், முதற்பதிப்பு, 1998.
4. வரதராசன். மு., "இலக்கிய வரலாறு", சாகித்ய அகாதெமி, ஒன்பதாம் பதிப்பு, 1994.
5. விமலானந்தம். மது.ச., "இலக்கிய வரலாறு", பாரி நிலையம், மறுபதிப்பு, 2008.

நோக்கம்: சங்க காலம் தொடங்கி தற்காலம் வரையிலும் தமிழில் உள்ள படைப்பிலக்கியங்களை இப்பாடம் அறிமுகம் செய்கின்றது. தமிழ் இலக்கியத்தில் தேர்ந்தெடுக்கப்பட்ட மிக முக்கியமான செய்யுட்கள், கவிதைகள், கதைகள், உரைநடை ஆகியவற்றைக்கொண்டு இப்பாடம் கட்டமைக்கப்பட்டுள்ளது. மாணாக்கரிடம் இலக்கியத் தேடலை உருவாக்குவதும், தற்சார்புடைய அறிவை மேம்படுத்துவதும் இப்பாடத்தின் நோக்கமாகும்.

அலகு 1 செவ்வியல் இலக்கியங்கள் 12

திருக்குறள்- அன்புடைமை, ஒழுக்கமுடைமை, பெரியாரைத்துணைக்கோடல் - மூன்று அதிகாரங்கள் முழுமையும்.

புறநானூறு- பாடல் எண்: 18, 55, 182, 183, 192 - ஐந்து பாடல்கள்.

குறுந்தொகை- பாடல் எண்: 2, 167, 27, 202, 184 - ஐந்து பாடல்கள்.

அலகு 2 காப்பியங்கள் 12

சிலப்பதிகாரம்- கனாத்திறம் உரைத்தக் காதை முழுவதும்.

மணிமேகலை- பவத்திறம் அறுக எனப் பாவை நோற்ற காதை முழுவதும்.

கம்பராமாயணம்- மந்தரைச் சூழ்ச்சிப்படலம் (தேர்ந்தெடுக்கப்பட்ட ஒன்பது பாடல்கள்).

அலகு 3 கவிதையும் புதுக்கவிதையும் 11

பாரதிதாசனின் 'தமிழியக்கம்' - (i) நெஞ்சு பதைக்கும் நிலை - (ii) இருப்பதைவிட இறப்பது நன்று - இரண்டு கவிதைகள்.

ஈரோடு தமிழன்பனின், "அந்த நந்தனை எரித்த நெருப்பின் மிச்சம்" என்னும் தொகுதியில் இடம்பெற்றுள்ள 'விடிகிறது' என்னும் புதுக்கவிதை.

அலகு 4 சிறுகதைகள் 12

தி. ஜானகிராமனின் 'சக்தி வைத்தியம்'

கி. ராஜநாராயணனின் 'கதவு' - இரண்டு கதைகள்

அலகு 5 உரைநடை 13

வைரமுத்து எழுதிய 'சிற்பியே உன்னைச் செதுக்குகிறேன்' முழுவதும்

மொத்தம்: 60 மணி நேரம்

பாட நூல்கள்

1. இரவிச்சந்திரன். ச. (ப.ஆ), “செய்யுள் திரட்டு”, வேல்ஸ் பல்கலைக்கழகம், முதற்பதிப்பு, 2008.
2. வைரமுத்து. இரா., “சிற்பியே உன்னைச் செதுக்குகிறேன்”, திருமகள் நிலையம், பதினேழாம் பதிப்பு, 2007.

பார்வை நூல்கள்

1. பாலச்சந்திரன்.ச., “இலக்கியத் திறனாய்வு”, நியூ செஞ்சரி புக் ஹவுஸ், பத்தாம் பதிப்பு, 2007.
2. மாதையன்.பெ., “தமிழ்ச் செவ்வியல் படைப்புகள்”, நியூ செஞ்சரி புக் ஹவுஸ், முதல் பதிப்பு, 2009.
3. வரதராசன்.மு., “குறள் காட்டும் காதலர்”, பாரி நிலையம், மறுபதிப்பு, 2005.

நோக்கம்: தற்கால அன்றாடத்தேவைக்குரிய வகையில் தமிழ்மொழியைச் செம்மையாகப் பயன்படுத்த வேண்டும் என்னும் நோக்கில் இப்பாடம் உருவாக்கப்பட்டுள்ளது. மாணாக்கரின் வேலைவாய்ப்பு நேர்காணல்கள் மற்றும் குழு உரையாடல்களை எதிர்கொள்வதற்கேற்ற பேச்சுத்திறன் மேம்பாடு, செய்தித்தாள்களை நுட்பமாக அணுகும்விதம், சிறந்த கடிதங்களை எழுதுவதற்கான பயிற்சி போன்ற பயன்பாடு சார்ந்த மொழிப்பயிற்சியை இப்பாடம் அளிக்கின்றது.

அலகு1 மொழி

11

பிழை நீக்கி எழுதுதல் - ஒற்றுப்பிழை நீக்கி எழுதுதல் - தொடர்பிழை நீக்கி எழுதுதல் - ஒற்று மிகும் இடங்கள் - ஒற்று மிகா இடங்கள் - பிற மொழிச் சொற்களை நீக்கி எழுதுதல் - பயிற்சிகள்.

அலகு2 பேச்சு

13

பேச்சுத்திறன் - விளக்கம் - பேச்சுத்திறனின் அடிப்படைகள்- வகைகள் - மேடைப்பேச்சு - உரையாடல் - குழுவாக உரையாடல் - பயிற்சிகள்.
தலைவர்களின் மேடைப் பேச்சுகள் - பெரியார் - அண்ணா - கலைஞர்.

அலகு3 எழுதுதிறன்

12

கலைச்சொல்லாக்கம் - தேவைகள் - கலைச்சொற்களின் பண்புகள் - கலைச்சொல்லாக்கத்தில் தவிர்க்க வேண்டியவை - அறிவியல் கலைச்சொற்கள்.

கடிதம் - வகைகள் - அலுவலகக் கடிதங்கள் - பயிற்சி - அறிஞர்களின் கடிதங்கள் - கடிதங்களின் வழி கற்பித்தல் - சில அறிஞர்களின் கடிதங்கள் - நேரு...,

அலகு4 மொழிபெயர்ப்பு

13

மொழிபெயர்ப்பு அடிப்படைக் கோட்பாடுகள் - மொழிபெயர்ப்பு முறைகள் - மொழிபெயர்ப்பாளரின் தகுதிகள்.

மொழிபெயர்ப்பு வகைகள் - சொல்லுக்குச் சொல் மொழிபெயர்த்தல் - தழுவல் - கட்டற்ற மொழிபெயர்ப்பு - மொழியாக்கப்படைப்பு - இயந்திர மொழிபெயர்ப்பு - கருத்துப்பெயர்ப்பு - மொழிபெயர்ப்பு நடை - மொழிபெயர்ப்பு சிக்கல்களும் தீர்வுகளும்.

பயிற்சி: அலுவலகக் கடிதங்களை மொழிபெயர்த்தல் (ஆங்கிலத்திலிருந்து தமிழுக்கு).

இதழ்களுக்குத் தலையங்கம் எழுதுதல் - நூல் மதிப்புரை எழுதுதல் - சாதனையாளரை நேர்காணல் - நிகழ்ச்சியைச் செய்தியாக மாற்றுதல்.

மொத்தம்: 60 மணி நேரம்

பார்வை நூல்கள்

1. ஈஸ்வரன்.ச., சபாபதி.இரா., “இதழியல்”, பாவை பப்ளிகேஷன்ஸ், முதற்பதிப்பு, 2004.
2. ஈஸ்வரன்.ச., “மொழிபெயர்ப்பியல்”, பாவை பப்ளிகேஷன்ஸ், முதற்பதிப்பு, 2005.
3. எட்கர் தார்ப், ஷோவிக் தார்ப், “நேர்முகத் தேர்வில் வெற்றிபெற”, கிழக்குப் பதிப்பகம், இரண்டாம் பதிப்பு, 2009.
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நோக்கம்: பண்டைத் தமிழரின் வாழ்வியல் நெறிகள் இயல்பானதும் இயற்கையோடு இணங்கிச் செல்வதுமாகும்; மிகவும் பழமையானதும் பண்பட்டதுமாகும். அன்பான அக வாழ்க்கையைக்கூட செம்மையாகத் திட்டமிட்டுள்ளனர். பொழுதுபோக்கு, போர்முறைகள், கலை, சமயம், அரசியல், அறிவியல் என அனைத்திலும் தமிழர் சிறந்து விளங்குவதை விளக்கும் பாடமாக இது அமைந்துள்ளது. அரசு வேலை வாய்ப்பிற்கான போட்டித் தேர்வுகளுக்குப் பயன்படும் வகையிலும் இப்பாடம் அமைந்துள்ளது.

அலகு 1 நாகரிகம், பண்பாடு

12

சொற்பொருள் விளக்கம் - பண்டைத் தமிழர் வாழ்வியல் - அகம் - களவு - கற்பு - குடும்பம் - விருந்தோம்பல் - உறவு முறைகள் - சடங்குகள் - நம்பிக்கைகள் - பொழுதுபோக்கு - புறம் - போர் முறைகள் - நடுகல் வழிபாடு - கொடைப்பண்பு.

அலகு2 கலைகள்

12

சிற்பம் - ஓவியம் - இசை - கூத்து - ஒப்பனை - ஆடை அணிகலன்கள்.

அலகு3 சமயம்

12

சைவம் - வைணவம் - சமணம், பௌத்தம் வெளிப்படுத்தும் பண்பாடு.

அலகு 4 அரசியல்

12

அரசு அமைப்பு - ஆட்சி முறை - உள்நாட்டு வணிகம் - வெளிநாட்டு வணிகம் - வரி வகைகள் - நாணயங்கள் - நீதி முறை.

அலகு5 அறிவியல்

12

கல்வி - வேளாண்மை - வானியல் அறிவு - மருத்துவம் - கட்டிடக்கலை.

மொத்தம்: 60 மணி நேரம்

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