ANNA UNIVERSITY:: CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
M.TECH. BIOTECHNOLOGY
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABUS
SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4110	Applied Statistics for Biotechnologists	FC	4	0	0	4	4
2.	BY4101	Advanced Molecular Biology and Genetic Engineering	PCC	3	0	0	3	3
3.	BY4102	Bioprocess Technology	PCC	3	0	0	3	3
4.	BY4103	Advanced Immunology	PCC	3	0	0	3	3
5.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Audit Course - I *	AC	2	0	0	2	0
PRACTICALS								
8.	BY4111	Immunotechnology Laboratory	PCC	0	0	6	6	3
			TOTAL	**20**	**0**	**6**	**26**	**21**

*** Audit Course is optional**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	BY4201	Bio Separation Technology	PCC	3	0	0	3	3
2.	BY4202	Computational Biology	PCC	3	2	0	5	4
3.	BY4251	Metabolic Process and Engineering	PCC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Professional Elective IV	PEC	3	0	0	3	3
7.		Open Elective	OEC	3	0	0	3	3
8.		Audit Course - II *	AC	2	0	0	2	0
PRACTICALS								
9.	BY4211	Preparative and Analytical Techniques In Biotechnology	PCC	0	0	6	6	3
			TOTAL	**23**	**2**	**6**	**31**	**25**

*** Audit Course is optional**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	BY4301	Advanced Genetic Engineering Laboratory	PCC	0	0	6	6	3
2.	BY4302	Bioprocess and Downstream Processing Laboratory	PCC	0	0	6	6	3
3.	BY4311	Project Work I	EEC	0	0	12	12	6
			TOTAL	**0**	**0**	**24**	**24**	**12**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	BY4411	Project Work II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

TOTAL NO. OF CREDITS:70

LIST OF PROFESSIONAL ELECTIVES

SEMESTER I, ELECTIVE I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BY4001	Advances in Animal Biotechnology	PEC	3	0	0	3	3
2.	BY4002	Plant Genetic Engineering and Biotechnology	PEC	3	0	0	3	3
3.	BY4003	Advances in Cancer Biology	PEC	3	0	0	3	3
4.	BY4004	Phytochemistry	PEC	3	0	0	3	3
5.	BY4005	Advances in Molecular Pathogenesis	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BY4006	Enzyme Engineering and Technology	PEC	3	0	0	3	3
2.	BY4007	Bio reactor Design and Control	PEC	3	0	0	3	3
3.	BY4008	Thermodynamics for Biological Systems	PEC	3	0	0	3	3
4.	BY4009	Biotechnology in Food Processing	PEC	3	0	0	3	3
5.	BY4010	Bioprocess Modelling and Simulation	PEC	3	0	0	3	3
6.	BY4011	Biofuels and Platform Chemicals	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BY4012	Molecular Medicine	PEC	3	0	0	3	3
2.	BY4071	Biomaterials and Tissue Engineering	PEC	3	0	0	3	3
3.	BY4013	Biopharmaceuticals and Biosimilars	PEC	3	0	0	3	3
4.	BY4014	Bio Nanotechnology	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	BY4015	Advanced Genomics and Proteomics	PEC	3	0	0	3	3
2.	BY4016	IPR, Biosafety and Entrepreneurship	PEC	3	0	0	3	3
3.	BY4017	Protein Structure Analysis	PEC	3	0	0	3	3
4.	BY4018	Computer Aided Learning of Structure and Function of Proteins	PEC	3	0	0	3	3
5.	BY4019	Computational Methods in Fluid Dynamics	PEC	3	0	0	3	3

AUDIT COURSES - I

REGISTRATION FOR ANY OF THESE COURSES IS OPTIONAL TO STUDENTS

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

MA4110	APPLIED STATISTICS FOR BIOTECHNOLOGISTS	L T P C 4 0 0 4

OBJECTIVES:

This course will help the students to

- Study the mathematical aspects of probability, determination of probability and moments.
- Study the distributions of discrete and continuous random variables and their properties.
- Obtain the covariance and correlation between jointly distributed random variables, interpret simple linear regression and fitting of curves by least square method.
- Study concepts and methods of sampling and various statistical tests in testing hypothesis on data.
- Analyze one-way, two-way and three-way classifications of analysis of variance and problems using them.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Sample spaces - Events - Axiomatic approach to probability - Conditional probability - Additional theorem - Multiplication theorem - Baye's theorem – Random variables : Continuous and discrete random variables - Distribution function - Expectation with properties - Moments, mean, variance problems - Continuous and discrete distributions.

UNIT II STANDARD DISTRIBUTIONS 12

Bivariate distribution - Conditional and marginal distribution - Discrete distributions - Binomial, Poisson, Geometric distributions - Continuous distributions - Normal, Exponential and Negative exponential, Gamma distributions - Simple problems - Properties.

UNIT III CORRELATION AND REGRESSION 12

Correlation coefficient - Properties - Problems - Rank correlation - Regression equations - Problems - Curve fitting by the method of least squares - Fitting curves of the form ax+b , ax^2+bx+c , ab^x and ax^b - Bivariate correlation application to biological problems.

UNIT IV SAMPLING AND TESTING OF HYPOTHESIS 12

Concept of sampling - Methods of sampling - Sampling distributions and standard error - Small samples and large samples - Test of hypothesis - Type I & Type II Errors - Critical region - Large sample tests for proportion, mean - Exact test based on normal , t , F and Chi - square distribution problems - Test of goodness of fit.

UNIT V ANALYSIS OF VARIANCE 12

Basic principles of experimentation - Analysis of variance - One - way, Two - way classifications - Randomized block design - Latin square design - Problems.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, students will be able to

- Mathematical basis and foundations of probability and statistics, computation of probability and moments, standard distributions of discrete and continuous random variables and standard distributions and their properties.
- Compute the covariance and correlation between jointly distributed variables.
- Compute and interpret simple linear regression and least square methods between two variables.
- Methods of sampling and application of various statistical tests in testing hypotheses on data.
- One-way and two-way classifications of analysis of variance, properties and assumptions, randomized block design and Latin square design problems

REFERENCES:

1. Devore, J. L., "Probability and Statistics for Engineering & Sciences", 8th Edition, Cengage Learning, 2014.

2. Gupta. S.C and Kapoor, V.K,. "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, New Delhi, 2020.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.
4. Rice, J. A., "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2013.
5. Ross, S. M., "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition, Elsevier, 2020.

BY4101 ADVANCED MOLECULAR BIOLOGY AND GENETIC ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the gene cloning methods and the tools and techniques involved in gene
- cloning and genome analysis and genomics.
- To explain the heterologous expression of cloned genes in different hosts, production of
- recombinant proteins and PCR techniques.
- To understand comparative genomics and proteomics.
- To provide extensive knowledge about Gene Regulation and Genome Editing in Genetic engineering applications.
- To explain the principles involved the creation of trangenic animals and plants.

UNIT I CLONING AND EXPRESSION OF GENES 9

Overview of Restriction and Modification system. Cloning vehicles: Plasmids – Host range, Copy number control, Compatibility. λ phage – Insertional and replacement vectors, in vitro packaging. Single strand DNA vector – M13 Phage, Cosmids, Phasmids, PAC, BAC and YAC. Expression vector – Characteristics, RNA probe synthesis, High level expression of proteins, Protein solubilization, purification and export.

UNIT II CONSTRUCTION OF DNA LIBRARIES 9

DNA library – types and importance. cDNA library: Conventional cloning strategies – Oligod T priming, self-priming and its limitations. Full length cDNA cloning – Capture method and Oligo capping. Strategies for gDNA library construction – Chromosome walking. gDNA and cDNA library. Screening strategy. Hybridization, PCR, Immuno-screening, South-Western and North-Western. Functional cloning – Functional complementation and gain of function. Difference cloning: Differential screening, Subtracted DNA library, differential display by PCR. Microarrays - Applications of microarrays.

UNIT III PCR, MUTAGENESIS AND DNA SEQUENCING 9

Polymerase Chain Reaction (PCR): Principle and applications. Different types of PCR (Hot start, touchdown, multiplex, inverse, nested, AFLP, allele-specific, assembly, Asymmetric, LATE, Colony, in situ, long). Real-time PCR, FRET, SYBR Green assay, Taqman probes, Molecular beacons. Mutagenesis and chimeric protein engineering by PCR, RACE, Kunkels' method of mutagenesis, Phage display and screening methodologies. DNA sequencing. Chemical and Enzymatic methods, Pyrosequencing, Automated sequencing, Genome sequencing methods – top -down approach, bottom- up approach, Next generation gene sequencing.

UNIT IV POST TRANSCRIPTIONAL GENE REGULATION AND GENOME EDITING 9

Role of siRNA, miRNA in gene regulation: siRNA- PTGS, Quelling, origin, components of gene silencing mechanisms, TGS, PTGS, Applications. miRNA- Identification, biogenesis, mechanism of action. Difference between siRNA and miRNA, effect of small RNAs on chromosomal DNA. Genome Editing tools: Genome editing- introduction, zinc finger nucleases, TALENS, CRISPR-Cas9 systems, applications.

UNIT V GENETIC ENGINEERING 9

Introduction of foreign genes into animal cells – Importance, DNA Microinjection, Retroviral vectors, Transfection of Embryonic stem cells, recombination. Transgenic plants –Ti Plasmid, Co integrate and Binary vectors, transgenic plants for disease resistance, abiotic stress resistance, enhanced nutritional value, Viral vectors, Engineering siRNA mediated gene knock downs (shRNA).

TOTAL : 45 PERIODS

COURSE OUTCOMES

After completion of the course the students will be able to

- **CO1** Gain knowledge in gene cloning methods and the tools and techniques involved in gene cloning and genome analysis and genomics.
- **CO2** Understand the heterologous expression of cloned genes in different hosts, production of recombinant proteins and PCR techniques.
- **CO3** Gain extensive knowledge in comparative genomics and proteomics.
- **CO4** Gain extensive knowledge about Gene Regulation and Genome Editing in Genetic engineering applications.
- **CO5** Understand the principles involved the creation of trangenic animals and plants.

REFERENCES:

1. Primrose S.B., Twyman R.H., and Old R.W. "Principles of Gene Manipulation." 7th Edition. Blackwell Science/Oxford, 2006
2. Winnacker E.L. "From Genes to Clones: Introduction to Gene Technology." Panima, 2003.
3. Glick B.R. and Pasternak J.J. "Molecular Biotechnology: Principles and Applications of Recombinant DNA, 3rd Edition. ASM Press, 2003.
4. Nelle W. and Hammann C. "Small RNAs: Analysis and Regulatory Functions (Nucleic Acids and Molecular Biology)", 2nd Edition. Springer Verlag Berlin and Heidelberg GmbH & Co. K, 2007
5. Lemonie, N.R and Cooper,D.N ,"Gene therapy",BIOSScientific, 1996.
6. Krishnarao Appasani. "Genome Editing and Engineering" Cambridge University press 2018.
7. Raghavachari Nalini, Garcia-Reyero Natàlia. "Gene expression analysis: Methods and protocols" 1st Edition, Humana Press, 2018.

BY4102 BIOPROCESS TECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on black box stoichiometries principles applicable in Biotechnology
- To impart knowledge on design and operation of fermentation processes with all its prerequisites.
- To endow the students with the basics of microbial kinetics, metabolic stoichiometry and energetics.
- To develop bioengineering skills for the production of biochemical product using integrated biochemical processes.
- To develop learning and understanding ability in case studies for fermentation derived products

UNIT I BLACK BOX MODEL 9

Yield coefficients, black box stoichiometries, elemental balances, heat balance, degrees of reduction balances, systematic analysis of black box stoichiometries, and identification of gross measurement errors

UNIT II DESIGN OF FERMENTATION PROCESSES 9

Kinetics of substrate utilization, biomass growth and product formation, inhibition of cell growth and product formation. Design and operation of continuous cultures, chemostat in series, batch and fed batch cultures, total cell retention cultivation.

UNIT III MODELING OF VARIOUS FERMENTATION PROCESSES 9

Principles of model building for biotechnological processes, unstructured models on the population level, structured models on the cellular level, morphologically structured model, genetically structured models, cybernetic model, modeling of recombinant systems.

UNIT IV BIOREACTOR DESIGN & CONSTRUCTION 9

Basic design and construction of CSTR, bioreactor design of agitator / agitator motor, power consumption in aerated bioreactor, design of sparger, mixing time estimation, oxygen mass transfer capability in bioreactor, Removal of Heat in bioreactor, Main parameters to be monitored and controlled in fermentation processes.

UNIT V CASE STUDIES IN FERMENTATION DERIVED PRODUCTS 9

Case studies on Production of green chemicals, algal biofuels, recombinant Insulin. Case studies on medium design, reactor design & process optimization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course the students will be able to

CO1: Gain knowledge on black box stoichiometries principles applicable in Biotechnology

CO2: Understand the design and operation of fermentation processes with all its prerequisites.

CO3: Gain knowledge in basics of microbial kinetics, metabolic stoichiometry and energetics.

CO4: Develop bioengineering skills for the production of biochemical product using integrated biochemical processes.

CO5: Develop learning and understanding ability in case studies for fermentation derived products

REFERENCES:

1. Shuler, M.L., Kargi F., “Bioprocess Engineering – Basic Concepts “, Prentice Hall, 2nd Edition, 2015.
2. Pauline D., “Bioprocess Engineering Principles “. Elsevier, 2nd Edition, 2012.
3. Nielsen, J. and Villadsen, J. “Bioreaction Engineering Principles”. Springer, 3rd Edition, 2011.
4. Lydersen B.K., “Bioprocess Engineering Systems, Equipment and Facilities” , Wiley Blackwell, 2nd Edition, 2010.
5. Bailey, J.E. and Ollis, D.F. “Biochemical Engineering Fundamentals", 2nd Edition, McGraw Hill, 2017.
6. Stanbury, P.F., Stephen J.H., Whitaker A., “Principles of Fermentation Technology”, Science & Technology Books, 2nd Edition, 2009.

BY4103 ADVANCED IMMUNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the structure, functions and integration of immune system
- To explain the antigen-antibody interactions that offers defence mechanism
- To educate the importance immunoregulation in Immunity development
- To explain various techniques of therapeutically significant monoclonal and engineered
- antibodies production
- To educate the importance of Immunotherapeutics development for Clinical Applications

UNIT I INNATE IMMUNITY 9

Introduction to the Immune system – Various components of the immune system – Innate immune response - Inflammatory response. Cellular and Molecular aspects of the innate immune system- Recognition of pathogens and activation of Toll-like receptors- complement system.

UNIT II ADAPTIVE IMMUNITY 9

Antibody structure and functions – Antibody mediated and cell mediated immunity – components of cell-mediated immunity. Antigen-processing and presentation. MHC – structure and function. Antigen receptors and accessory molecules of T lymphocytes- B- cell development and activation, generation of B-cell diversity – Mechanism of immunoglobulin – gene arrangement and immunoglobulin superfamily. T-cell development – Generation of TCR diversity – Biology of Cytokines.

UNIT III IMMUNOREGULATION 9

Helper and suppressor cells, mechanism in immunity. Inflammation – mechanism and significance. Transplantation immunology- graft rejection and HLA antigens. Role of MHC and T cells. Prevention of graft rejection. Hypersensitivity- immediate and delayed types; mechanism and reactions. Vaccines – types, production and uses. Immunity to virus, bacteria and parasites- genetic control of immune response. Immunosuppression.

UNIT IV IMMUNOLOGICAL TECHNIQUES 9

PBMC separation from the blood; Isolation of monocytes/macrophages. Macrophage culture. Isolation of dendritic cells. Identification of lymphocytes based on CD markers; Production of monoclonal antibodies and Polyclonal antibodies. Principle and applications of immunoassays: RIA, ELISA, IRMA, ELFIA, ECLIA, DELFIA, TRIFMA, SLFIA, and western blot. Precipitation reaction – immunodiffusion, immune-electrophoresis, precipitin ring test. Agglutination tests –hemagglutination, febrile and latex agglutination- applications. Tumor Cell imaging Techniques- In vitro and In vivo cell tracking techniques; Immuno-electron microscopy, Immunofluorescence microscopy, Flurochromes; Staining techniques for live cell imaging and fixed cells; Flow cytometry

UNIT V IMMUNOTHERAPEUTICS 9

Recombinant Antibodies, Bispecific Antibodies, catalytic antibodies, humanized antibodies, monoclonal antibodies: Antibody-drug conjugates (ADCs), radiolabeled antibodies, immunotoxins, cancer vaccines (tumor cell vaccines), Antigen vaccines, dentritic cell vaccines. DNA vaccines, cell based therapeutics.

TOTAL : 45 PERIODS

COURSE OUTCOMES

After completion of the course the students will be able to

- **CO1** Understand the structure, functions and integration of immune system
- **CO2** Understand the antigen-antibody interactions that offers defence mechanism
- **CO3** Gain knowledge in importance of learning immunoregulation in Immunity development
- **CO4** Understand the importance of various techniques of therapeutically significant monoclonal and engineered antibodies production
- **CO5** Gain knowledge in Immunotherapeutics development for Clinical Applications

REFERENCES

1. Peter J. Delves., Seamus J. Martin., Dennis R. Burton., Ivan M. Roitt., “Essential Immunology”, Wiley - Blackwell; 13th Edition, 2017.
2. Kuby J., “Immunology”, WH Freeman & Co., 8th Edition, 2018.
3. Abbas, K.A., Litchman, A.H., Pober, J.S., “Cellular and Molecular Immunology”, Elsevier., 9th Edition, 2017.
4. Wilson K and Walker J., “Practical Biochemistry”, Cambridge University Press. 8th Edition, 2018
5. Weir, D.N, “Handbook of Experimental Immunology”, Wiley-Blackwell Publishers, 5th Edition 1997

RM4151 **RESEARCH METHODOLOGY AND IPR** **L T P C**
2 0 0 2

UNIT I RESEARCH DESIGN **6**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES **6**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING **6**

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS **6**

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS **6**

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL : 30 PERIODS

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

BY4111 **IMMUNOTECHNOLOGY LABORATORY** **L T P C**
0 0 6 3

COURSE OBJECTIVES

- To give practical exposure in the clinical diagnosis.
- To give laboratory training in different immunotechnological techniques.
- To give hands on training in cell staining, separation and identification

LIST OF EXPERIMENTS

1. *Preparation of antigen and Routes of immunization (Intraperitoneal, Sub-cutaneous, Intramuscular, Intra- nasal, Oral – VIRTUAL DEMO)
2. *Methods of bleeding (Tail bleeding, Intravenous, intraorbital - VIRTUAL DEMO)
3. Collection of serum, storage and purification of total IgG (salt precipitation).
4. Evaluation of Antibody titre by direct ELISA
5. Evaluation of Antigen by Sandwich ELISA
6. Characterization of antigens by native and SDS-PAGE
7. Characterizations of antigens by Western blot analysis – Wet and semidry transfer
8. Conjugation of Immunoglobins (Streptavidin, colloidal gold)

9. Methods for prototype development of Immunodiagnostics (ICT card)
10. Blood smear identification of leucocytes by Giemsa stain
11. Separation of mononuclear cells by Ficoll-Hypaque
12. Separation of splenocytes and proliferation against mitogens

*** Approval of IAEC is mandatory for experiments involving Live animals**

TOTAL : 90 PERIODS

LIST OF EQUIPMENTS REQUIRED

Microscopes,
Purification columns,
Microplate reader,
UV spectrometer,
PAGE apparatus,
Western blot apparatus,
Centrifuge,
Haemocytometer,

COURSE OUTCOMES

After completion of the course the students will be able to

- Understand the clinical diagnosis methods and its importance.
- Gain training in different immunotechnological techniques.
- Gain hands on training in cell staining, separation and identification

BY4001 ADVANCES IN ANIMAL BIOTECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To educate the students about the scope, regulatory issues and commercially available products produced using of animal biotechnology.
- To provide depth knowledge about the available viral vectors that can be used to create recombinant DNA for gene therapy purposes so that they can undertake research /project work related to biopharming.
- To teach the importance of cell culture study for invitro study purposes and for scaling up the products at commercial level.
- To provide depth knowledge about creaion of recombinant products for gene therapy purpose and the importance of molecular probe which is an important tool for medical and forensic studies.
- To educate the principle behind invitro fertilization and biopharming in order to create transgenic animal of commercial importance.

UNIT I INTRODUCTION 6

Scope of Animal Biotechnology, Animal Biotechnology for production of regulatory proteins, blood products, vaccines, hormones and other therapeutic proteins.

UNIT II MOLECULAR BIOLOGY 9

Biology of animal viral vectors- SV40, adeno virus, retrovirus, vaccinia virus, herpes virus, adeno associated virus and baculo virus. Applications of commercially available viral vectors and their pros and cons

UNIT III CELL CULTURE TECHNOLOGY 10

Culturing of cells, primary and secondary cell lines, Cell culture-Scaling up of animal cell culture-monolayer culture, suspension culture; Various bio-reactors used for animal cell culture-Roller bottle culture; Bioreactor process control, stirred animal cell culture, Air-lift fermentor, hemostat/Turbidostat; High technology vaccines; Hybridoma technology; Cell lines and their applications

UNIT IV GENETIC ENGINEERING 10

Gene therapy-prospects and problems, Recent advancements in Gene therapy; Knock out mice and mice model for human genetic disorder; Baculo virus in biocontrol; Enzymes technology, Somatic manipulation of DNA, Nucleic acid hybridization and probes in diagnosis- preparation of probes, evaluation and applications.Recent advancements in diagnostic tool development and its diagnostic procedure

UNIT V ADVANCEMENTS AND APPLICATIONS 10

Rumen manipulation- probiotics embryo transfer technology, invitro fertilization, transgenesis-methods of transferring genes into animal oocytes, eggs, embryos andspecific tissues by physical, chemical and biological methods; Biopharming –Transgenic animals (case study **:** Mice, Cows, Pigs, Sheep, Goat, Birds and Insects); Artificial insemination and embryo transfer.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After completion of the course the students will be able to:

CO1 Understand the scope, regulatory issues and commercially available products produced using of animal biotechnology.

CO2 Gain knowledge about the available viral vectors that can be used to create recombinant DNA for gene therapy purposes so that they can undertake research /project work related to biopharming.

CO3 Understand the importance of cell culture study for *invitro* study purposes and for scaling up the products at commercial level.

CO4 Gain knowledge in creating recombinant products for gene therapy purpose and the importance of molecular probe which is an important tool for medical and forensic studies.

CO5 Understand the principle behind *invitro* fertilization and biopharming in order to create transgenic animal of commercial importance.

REFERENCES:

1. Watson, J.D., Gilman, M., WitowskiJ. and Zoller, M. Recombinant DNA, 3rd ed., Scientific American Books, 2007
2. Glick, B.R. and Pasternack, J.J. Molecular Biotechnology, 3rd ed., ASM Press, 2003
3. Lewin, B. Genes VIII , Pearson Prentice Hall, 2004.
4.. Davis J.M. Basic Cell Culture: A Practical Approach, IRL Press, 2nd ed., 2002
5. Freshney R.I. Animal Cell Culture- a practical approach, 6th ed., 2010

BY4002 PLANT GENETIC ENGINEERING AND BIOTECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on organization of plant genomes and functional characterization of genes.
- To impart knowledge on molecular mechanism of plant-microbe interactions
- To impart knowledge on tissue culture, transformation techniques and transgenic plants
- To impart knowledge on plant genetic engineering and applications
- To impart knowledge on plant functional genomics and genome editing

UNIT I PLANT GENOME AND GENE EXPRESSION 9

Plant genome organization – Arabidopsis and Rice nuclear genome, Endosymbiotic theory - Chloroplast and mitochondrial genome organization, Cytoplasmic male sterility; RNA editing, Regulation of gene expression, epigenetic regulations, protein targeting

UNIT II TISSUE CULTURE TECHNIQUES 9

Introduction to plant tissue culture, tissue culture media; Micropropagation; production of artificial seeds; Double haploid production by androgenesis and gynogenesis; triploid production by endosperm culture; Cell Suspension cultures; protoplast isolation and regeneration, somatic hybridization and cybridization; clonal variation for crop improvement; Cryopreservation; Hairy root cultures, synthetic seed technology

UNIT III PLANT MICROBE INTERACTIONS 9

Types of plant microbe interactions- Pathogens, endophytes and symbionts: Molecular basis of plant pathogen interactions, gene-for-gene interactions, mechanism of pathogenesis in plants (Bacterial and fungal pathogens) – Pathogen effector molecules, Overview of plant immunity and defense-Plant defense mechanisms- preformed defense, induced defense, Plant resistant proteins, PR- proteins. Agrobacterium biology –Ti plasmid and T-DNA transfer, Symbiotic nitrogen fixation in legumes by Rhizobia- Molecular biology and biochemistry of nitrogen fixation, nif, nod genes, nitrogenase function

UNIT IV PLANT GENETIC ENGINEERING 9

Methods of transformation- Microprojectile bombardment, Agrobacterium mediated transformation, cointegrate and binary vectors, Plant selectable markers, reporter genes, marker-free plants, transgenic plants for crop improvement-disease resistance, insect resistance, herbicide resistance, FlavrSavr Tomato, Golden rice, Bt. cotton, Roundup- ready crops, metabolic engineering and molecular pharming (Edible vaccines).

UNIT V PLANT FUNCTIONAL GENOMICS AND GENOME EDITING 9

Plant functional genomics-Reverse genetics technique, Forward Genetics-T-DNA tagging, Transposon tagging, Activation tagging, Entrapment tagging, RNAi, gene targeting by homologous recombination in plants, Targeted genome engineering Zinc Finger Nucleases, TALENS, CrispR Cas9 system

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able

CO1 To acquire basic knowledge on organization of plant genome and regulation of gene expression
CO2 Be able to explain the molecular basis of plant microbe interactions
CO3 Get acquainted with the principles and practice of tissue culture techniques
CO4 Become proficient in designing experiments for development of transgenic plants to increase the yield
CO5 Gain knowledge on high throughput functional genomics and genome editing tools

REFERENCES:

1. Slater A., Nigel W.S., “Plant Biotechnology: The Genetic Manipulation of Plants”, Oxford University Press, 2nd Edition, 2008.
2. Mantell S.H., Mathews J.A., Mickee R.A., “Principles of Plant Biotechnology: An Introduction to Genetic Engineering in Plants” Blackwell Scientific Publication, 1st Edition, 1985.
3. Dodds J.H., “Plant Genetic Engineering”, Cambridge University Press, 1st Edition, 2012.
4. Gamburg O.L., Philips G.C., “Plant Tissue & Organ Culture fundamental Methods”, Narosa Publications, 2000.
5. Buchanan B., Gruissem W., Jones R., “Biochemistry & Molecular Biology of Plants”, Wiley Blackwell, 2nd Edition, 2015.
6. Heldt H.W., Piechulla B., “Plant Biochemistry”, Oxford University Press, 3rd Edition, 2007.
7. Robert H. Smith, “Plant tissue culture: Techniques and Experiments”, Academic Press Inc;3rd edition, 2013

BY4003 **ADVANCES IN CANCER BIOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To educate about the basics principles of cancer biolog
- To educate about the factors involved in development of carcinogenesis.
- To understand the basics concepts involved in molecular biology of cancer.
- To educate the basic mechanism involved in cancer metastasis.
- To educate the importance of various therapies involved in cancer treatments.

UNIT I PRINCIPLES OF CANCER BIOLOGY **9**

Cancer: Definition, causes, properties, classification, clonal nature – Cell Cycle: Regulation of cell cycle, cell proliferation and apoptosis – Signal transduction pathways –Growth factors, Apoptosis: apoptotic pathways, signal molecules, effects on receptor, signal switches – Modulation of cell cycle in cancer – Mechanism of spread.

UNIT II PRINCIPLES OF CARCINOGENESIS **9**

Cancer risk factors – Theory of carcinogenesis – Chemical carcinogenesis – Physical carcinogenes is: x-ray radiation – mechanisms of radiation carcinogenesis – Stages of cancer: initiation, promotion, progression.

UNIT III MOLECULAR ASPECTS OF CANCER AND ITS METASTASIS **9**

Transformation – Activation of Kinases – Oncogenes – Mechanism of oncogene activation – Retroviruses and oncogenes – Detection of Oncogenes – Oncogenes/proto-oncogene activity – Tumor Suppressor Genes: – Telomerases –- Clinical significances of Invasion –— Metastatic cascade– Recent approach to identify key factors controlling Metastasis.

UNIT IV CANCER SCREENING-DIAGNOSIS AND PREVENTION MODALITIES **9**

Life Style, Dietary Factors and Complementary Medicines (Yoga, Meditation, Acupuncture, Exercise & Probiotics) and their Pathways, Screening Principles, Developing and Evaluating a Cancer Screening Program, Various Screening Modalities for specific types of Cancer, Genetic Counselling, Biomarkers in Tumour Clinical Practice, Circulating and Cellular Tumour Markers, In vivo Tumour Imaging, Advances in Cancer Detection - Detection of Metastasis and Micro metastasis.

UNIT V CANCER THERAPY **9**

Therapy forms – Surgery, Chemotherapy, Radiation therapy - Detection of Cancers – Prediction of Aggressiveness of Cancer —New approaches of Cancer therapy – Cancer Immuno therapy - Monoclonal antibodies and Cancer Treatment, Gene therapy, Cancer Stem cell Targeted Therapy – Introduction to Personalized Medicine, Therapeutic and Preventive Vaccines. Cancer Clinical Trials - Ethical and Regulatory Affairs. Bio-Nanotechnology based product treatments and Targeted drug delivery systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course the students will be able to

CO1 Understand the basics principles of cancer biology.
CO2 Understand the factors involved in development of carcinogenesis.
CO3 Understand the basics concepts involved in molecular biology of cancer.
CO4 Understand the basic mechanism involved in cancer metastasis.
CO5 Understand the importance of various therapies involved in cancer treatments.

REFERENCES:

1. Fialho, A. and Chakrabarty, A., “Emerging Cancer Therapy: Microbial Approaches and Biotechnological Tools” 1 st Edition, Wiley, 2010.
2. Pelengaris, S. and Khan, M., “The Molecular Biology of Cancer”, Blackwell Publishing, 2006.
3. Ruddon, R.W., “Cancer Biology”, 2nd Edition, Oxford University Press, 2007
4. Schulz, W.S., “Molecular Biology of Human Cancers – An Advanced Students Text Book”, Springer, 2005.

5. Weinberg, R.A., “The Biology of Cancer”, Taylor & Francis, Garland Science, 2007
6. Molecular Biology of Cancer: Mechanisms, Targets and Therapeutics, Lauren Pecorina, Oxford University Press,2008.
7.The Cell; A Molecular Approach, Geoffrey M Cooper, ASM Press, 2013

BY4004 **PHYTOCHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To give the details of plant derived value added compounds and its functions .
- To educate the importance of phytocompounds application to fight againts various microbial infections
- To provide knowledge on biotech based production of agro medicines separation techniques
- To educate about the basic principles and techniques involved in structure elucidation and Molecular Modeling
- To provide knowledge on secondary metabolites and its role in development of herbal therapeutics

UNIT I INTRODUCTION TO PHYTOMEDICINE 9

Phytochemicals and their classification–Phytochemical screening –Physiochemical tests – Macroscopic and microscopic techniques –Traditional plant and Herbal remedies — Herbal drugs WHO guidelines–Standardization of Herbal Drugs Derivatives with Special Reference to Brazilian Regulations

UNIT II PHYTOCOMPOUNDS 9

Plant extract used to Bacterial, Fungal and Parasitic infection – Biological and Toxicology Properties of plant extract –Anti-MRSA and Anti-VRE activities of Phytoalexins and Phytoncides– Anti microbial and targeted screening of Plant extract – Plant derived compound against drug resistant microorganisms – Antioxidant and antitumor Plant metabolites (fruits and vegetables)– Bioactive compounds as food

UNIT III PHYTOMEDICINE 9

Medicinal Plants for Development of Phytomedicine and Use in Primary Health Care– Immunostimulants and adaptogen from Plants –Polyphenols for Atherosclerosis and Ischemic Heart disease –Cancer Chemopreventive agents –Lipidoxidation nitrogen Radicals– Phytochemicals in oilseeds – Flavonoids in Cardiovascular disease – Bioengineering and Breeding approaches in improving phytochemical content of plants.

UNIT IV SEPARATION TECHNIQUES AND STRUCTURE ELUCIDATION 9

Thin layer chromatography– HPTLC– Column chromatography – GC-MS – LC-MS –HPLC – Partition chromatography – Gas chromatography – FT-IR – UV- NMR (1D&2D) – X-ray diffraction - QSAR and Molecular Modeling

UNIT V SECONDARY METABOLITE 9

Secondary metabolite production through cell culture system–Hairy root induction–Methods of gene transfer–Chemical methods– PEG – dextran–Physical method– Electroporation– Microinjection– Lipofection delivery for herbal therapeutics–Quality Control –Germplasm improvement

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course the students will be able to

CO1 Understand the importance the plant derived value added compounds and its functions .
CO2 Understand the importance of phytocompounds application to fight againts various microbial infections
CO3 Develop depth knowledge on biotech-based production of agro medicines separation techniques
CO4 Understand the basic principles and techniques involved in structure elucidation and Molecular Modeling
CO5 Develop depth knowledge on secondary metabolites and its role in development of herbal therapeutics

REFERENCES:

1. Ahamed, I., Aqil, F. and Owais, M."Modern Phytomedicine", Turning medicinal Plants into drugs. WILEY VCH, Verlag GmbH & Co, KGaA, Weinheim. 2006.
2. Arnason, J.T., Arnason, J.E. and Arnason, J.T.,"Phytochemistry of Medicinal Plants", Kluwer Academic Publishers, 1995.
3. Bidlack, W.R., Omaye, S.T., Meskin, M.S.and Topham, D.K.W.," Phytochemicals as Bioactive Agents", 1St Edition, CRC Press, 2000.
4. Meskin, M.S., Bidlack, W.R., Davies, A.J. and Omaye, S.T., "Phytochemicals in Nutrition and Health", CRC Press, 2002.
5. Rasooli, I, "Bioactive compounds in Phytomedicine" , Intech Open access Publishers , 1st Edition, 2011
6. Durgesh Nandini Chauhan and Kamal Shah ,"Phytopharmaceuticals Potential Therapeutic Applications",Scrivener publishing,Wiley,2021

BY4005 ADVANCES IN MOLECULAR PATHOGENESIS **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know about the host pathogen interaction and identifying virulence factors involved in viral pathogenesis
- To educate about vaccine development and functional genomic approaches in treatment of fungal pathogenesis
- To provide depth knowledge in clinical significance in bacterial pathogenesis treatments
- To understand about the microbial toxins and modern molecular pathogenesis
- To control pathogens by modern approaches.

UNIT I VIRAL PATHOGENESIS **9**

Various pathogen types and modes of entry – Viral dissemination in the host – Viral virulence – Injury induced by virus – Host susceptibility of viral disease – Pattern of infection - Acute infection – Persistant infection – Latent infection – Slow infection – Methods for the study of pathogenesis – Foot and mouth disease virus, Pestiviruses, Arteriviruses, Blue tongue virus and Animal herpesviruses

UNIT II FUNGAL PATHOGENESIS **9**

Innate humoral immunity to fungi – Acquired cellular immunity – Mucosal immunity – Intracellular pathogenesis of *Histoplasma capsulatum* – Facultative intracellular pathogen of *Cryptococcus neoformans* – Fungal interaction with leukocytes – Fungal vaccine development – Host defence against chronic disseminated *Candidiasis* – Study fungal virulence by using Genomics – Functional genomic approaches to fungal pathogenesis.

UNIT III BACTERIAL PATHOGENESIS 9

Epidemology and Clinical disease – Clinical course and basic immunology – *In vitro* models of *Salmonella* virulence – Antibiotic resistant *Salmonella* – *Salmonella* based vaccines – *Shigella* cellular models of infection – Influenza virus – Pathogenic *Escherichia coli* – *Vibrio cholerae* – Streptococcal disease – *Haemophilus influenzae* infection.

UNIT IV MANIPULATION OF HOST CELLS AND IMMUNE FUNCTION BY VIRAL PROTEINS 9

Clinical importance of understanding host defence – Interference with cytokine and Chemokine function – impairment of host mediated killing of infected cells – inhibition of apoptosis – Immunological structure of proteins – Class I and II MHC mediated antigen – Evasion from natural killer cells.

UNIT V MOLECULAR APPROACHES TO CONTROL 9

Classical approaches based on serotyping – Modern diagnosis based on highly conserved virulence factors, immune and DNA based techniques – New therapeutic strategies based on recent findings on molecular pathogenesis – Viral Vaccines – Immune modulators – New vaccine technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course the students will be able to

CO1 Understand the host pathogen interaction and identifying virulence factors involved in viral pathogenesis
CO2 Gain about vaccine development and functional genomic approaches in treatment of fungal pathogenesis
CO3 Gain depth knowledge in clinical significance in bacterial pathogenesis treatments
CO4 Understand about the microbial toxins and modern molecular pathogenesis
CO5 Understand the methods involved in control of pathogens by modern approaches.

REFERENCES:

1. Flint, J., Enquist, L.W., Krug, “Principles of Virology: Molecular Biology, Pathogenesis and Control”, American Society of Microbiology, 2003.
2. Groismen, E.A., “Principles of Bacterial Pathogenesis”, Academic Press, 2001.
3. Gyles, C.L., Prescott, J.F., Songer, J.G. and Thoen C.O., “Pathogenesis of Bacterial Infections in Animals”, 3rd Edition, Wiley-Blackwell, 2004.
4. Mettenleitter, T.C. and Sobrino, F.,“Animal Viruses: Molecular Biology”, Caister Academic Press, 2008.
5. Norkin, L.C., “Virology: Molecular Biology and Pathogenesis”, ASM Press, 2009.
6. Madigan, Michael T. “Biology of Microorganisms”, 15th ed., 2017
7. Salyers, Abigail A. “Bacterial Pathogenesis: A Molecular Approach”, 3rd ed., 2010

AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES

CO1 –Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

AX4092 DISASTER MANAGEMENT L T P C
2 0 0 0

OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION **6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS **6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA **6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT **6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT **6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES

CO1: Ability to summarize basics of disaster

CO2:Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

AX4093 **CONSTITUTION OF INDIA** **L T P C**
2 0 0 0

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094 நற்றமிழ் இலக்கியம் **L T P C 2 0 0 0**

UNIT I சங்க இலக்கியம் **6**

1. தமிழின் துவக்க நூல் தொல்காப்பியம் – எழுத்து, சொல், பொருள்
2. அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195) - போரை நிறுத்திய ஔவையார்

UNIT II **அறநெறித் தமிழ்** **6**

1. அறநெறி வகுத்த திருவள்ளுவர்
   - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து

– ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III **இரட்டைக் காப்பியங்கள்** **6**

1. கண்ணகியின் புரட்சி
   - சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
   - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV **அருள்நெறித் தமிழ்** **6**

1. சிறுபாணாற்றுப்படை
   - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
   - அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
   - இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
   - சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
   நற்றிணை (11) - நண்டு
   கலித்தொகை (11) - யானை, புறா
   ஐந்திணை 50 (27) - மான்
   ஆகியவை பற்றிய செய்திகள்

UNIT V **நவீன தமிழ் இலக்கியம்** **6**

1. உரைநடைத் தமிழ்,
   - தமிழின் முதல் புதினம்,
   - தமிழின் முதல் சிறுகதை,
   - கட்டுரை இலக்கியம்,
   - பயண இலக்கியம்,
   - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

<u>தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்</u>

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) -https://ta.wikipedia.org
3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம் - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்