

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
ACCREDITED BY NAAC WITH 'A++' GRADE

UNDERGRADUATE DEGREE PROGRAMME

B.Sc., Biotechnology

Three Years

/

B.Sc., (Hons) Biotechnology

Four Years

CURRICULUM & SYLLABUS

REGULATION 2024

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2024 -2025

Department of Biotechnology
School of Life Sciences



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
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DEPARTMENT OF BIOTECHNOLOGY

VISION OF THE DEPARTMENT
To develop as a department of eminence by achieving high standards in both research and teaching, and to become a sought-after destination for highly motivated students and faculty. The department aspires to deliver distinctive learning skills in biotechnology, enabling excellence in professional competence and innovation for the further betterment of society and mankind.

MISSION OF THE DEPARTMENT	
M1	To maintain high standards of teaching by innovating pedagogy, instilling in students the ability to be lifelong learners, and continually upgrading the program curriculum to meet international standards of life sciences education and to meet the requirements of industry and the research community.
M2	To adopt effective teaching methods to improve the learning process and impart knowledge of biology and technology. To provide a flexible curriculum that allows the students to study courses of his/her choice (through elective courses) that will fulfil their aptitude and professional aspirations.
M3	To provide hands-on training and technical skills to transform students into technocrats and facilitate research and higher education in the fields of biotechnology.
M4	To create opportunities and a supporting infrastructure for students through laboratory courses, projects, dissertations, and possible entrepreneurial ventures in biotechnology to achieve their aspirations.
M5	To pursue and promote cutting-edge research in selected fields of biotechnology.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	The graduates of biotechnology will be able to attain in-depth knowledge of the basic and application-oriented subjects of biotechnology and allied fields.
PEO2	The graduates of biotechnology will be able to gain the ability to use the concept of theories, practical skills, and latest technological tools to solve any professional issues independently in a global and societal context.
PEO3	The biotechnology graduates are prepared to design, evaluate, conduct, and interpret experiments and data in order to develop processes/products within realistic limits.
PEO4	The biotechnology graduates will continue to learn and upgrade their knowledge to become entrepreneurs in the current competitive world of science & technology and also contribute to society.
PEO5	The biotechnology graduates are trained to demonstrate creativity, develop innovative ideas and to work in teams to accomplish a common goal.

PROGRAMME OUTCOMES (PO)	
PO1	**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.
PO2	**Problem analysis:** Graduates will be able to analyse, solve and troubleshoot problems in implementation of biochemistry/biotechnology/ microbiological protocols.
PO3	**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.
PO4	**Conduct investigations of complex problems:** Graduates will acquire practical skills, which help in planning and designing protocols to validate hypotheses and execute experimental techniques independently, as well as assimilate, analyse, and

	interpret subsequent data.
PO5	**Modern tool usage and communication:** Graduates will effectively be able to manage resources and time using ICT and computer enabled devices and will have the ability to understand and communicate all ideas effectively.
PO6	**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.
PO7	**Lifelong learning:** Graduates will carry on to learn and adapt in a world of constantly evolving technology.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	To impart an ability to apply biotechnology skills (including molecular & microbiology, immunology & genetic engineering, bioprocess & fermentation, enzyme & food technology and bioinformatics) and its applications in core and allied fields.
PSO2	A Demonstrate the application of Biotechnological processes in industries that are of social and commercial importance.
PSO3	To impart in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

BOARD OF STUDIES

List of Members

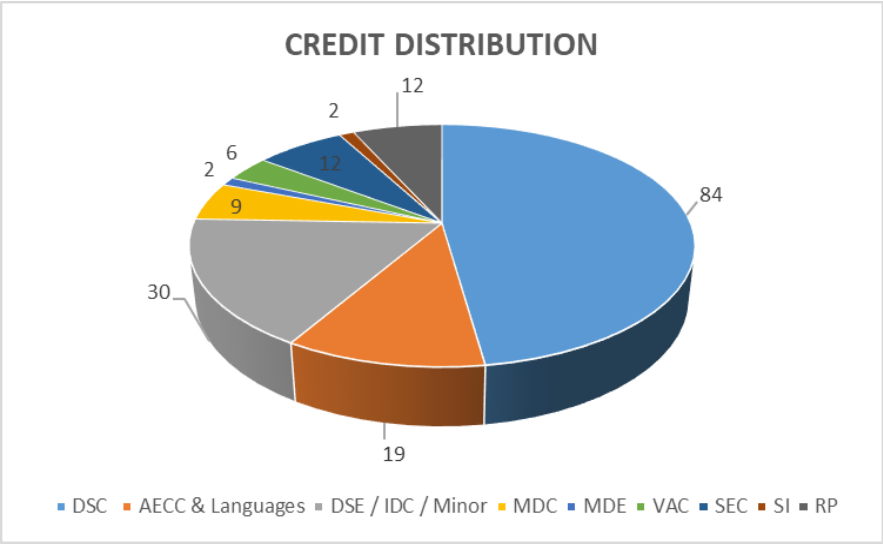
Department of Biotechnology

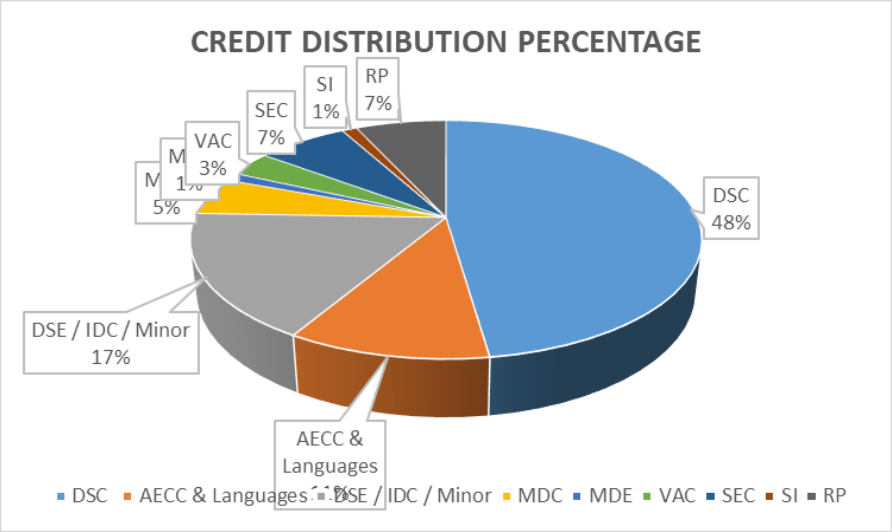
S. No	Name & Designation	Address	Role
1.	Dr. K. Ashok Kumar	Associate Professor & HOD, Department of Biotechnology	Internal Member
2.	Dr. Rajeswary Hari	Professor & Head, Department of Biotechnology, Dr MGR Educational & Research Institute University, Maduravoyal, Chennai - 600 117	Academic Expert (External Member)
3.	Dr. P. Balashanmugam	Director, AviGen Biotech Pvt Ltd. No. 7, 1st floor, 1st main road, New Colony, Chrompet, Chennai 600 044.	Industrial Expert (External Member)
4.	Dr. N. K. Udaya Prakash	Professor, Department of Biotechnology, VISTAS	Internal Member
5.	Dr. B. Prakash	Associate Professor, Department of Biotechnology, VISTAS	Internal Member
6.	Dr. M. Thenmozhi	Associate Professor, Department of Biotechnology, VISTAS	Internal Member
7.	Dr. M. Jayanthi	Assistant Professor, Department of Biotechnology, VISTAS	Internal Member
8.	Dr. J. Manjunathan	Assistant Professor, Department of Biotechnology, VISTAS	Internal Member
9.	Ms. Preethi	Lab Technician Life Cell International, Chennai.	Alumni Member (External Member)

CREDIT DISTRIBUTION

B.Sc., (Hons) in Biotechnology
Minimum credits to be earned: 176
B.Sc., Biotechnology
Minimum credits to be earned: 132

Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	3 Yrs. Total Credits	VII Sem	VIII Sem	4 Yrs Total Credits
DSC	8	8	8	8	9	16	60	12	12	84
AECC & Languages	4	4	4	7	-	-	19	-	-	19
DSE / IDC / Minor	4	4	3	4	4	3	22	4	4	30
MDC	3	3	3	-	-	-	9	-	-	9
MDE	-	-	2	-	-3	-	2	-	-	2
VAC	1	2	-	1	2	-	6	-	-	6
SEC	2	2	2	2	2	2	12	-	-	12
SI	-	-	1	-	1	-	2	-	-	2
RP	-	-	-	-	-	-	-	6	6	12
Total Credits	22	23	23	22	21	21	132	22	22	176





ABBREVIATIONS

DSC	Disciplinary Specific Core
AECC	Ability Enhancement Compulsory Courses
DSE	Disciplinary Specific Elective
IDC	Interdisciplinary / Minor Courses
MDC	Multidisciplinary Courses
VAC	Value Added Courses
SEC	Skill Enhancement Courses
SI	Summer Internship
RP	Research Project

CURRICULUM STURCTURE

B.Sc., Biotechnology Three Years
/
BSc., (Hons) in Biotechnology Four Years

Total number of Credits: 176

	B.Sc., Biotechnology (Hons) Minimum Credits to be earned :176 B.Sc., Biotechnology Minimum Credits to be earned: 132									
SEMESTER 1										
			Hours/Week					**Maximum Marks**		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 1	24LTAM11/ 24LHIN11/ 24LFRE11	Tamil I / Hindi I/ French I	2	0	0	1	2	40	60	100
ENG 1	24LENG11	English I	2	0	0	1	2	40	60	100
DSC 1	24CBBT11	Cell Biology and Genetics	3	0	0	2	3	40	60	100
DSC 2	24CBBT12	Molecular Biology	4	0	0	2	4	40	60	100
MDC 1	24MBBT11	Nutrition and Health	3	0	0	2	3	40	60	100
DSE 1/ IDC 1 / Minor 1	24DBBT1-	Discipline Specific Elective – I	4	0	0	2	4	40	60	100
DSC 1 (Lab)	24PBBT11	Practical I Cell Biology, Genetics	0	0	2	1	1	40	60	100
VAC 1	24DVAC11	Universal Human Values	1	0	0	1	1	-	100	100
SEC 1	24SSKU11	Soft Skills I	2	0	0	1	2	40	60	100
SEC 2		Orientation programme / Industrial Visit	-	-	-	-	-	-	-	-
			21	**-**	**2**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C – Credits**

SEMESTER 2										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 2	24LTAM21/ 24LHIN21/ 24LFRE21	Tamil II / Hindi II / French II	2	0	0	1	2	40	60	100
ENG 2	24LENG21	English II	2	0	0	1	2	40	60	100
DSC 3	24CBBT21	Fundamentals of Microbiology	3	0	0	2	3	40	60	100
DSC 4	24CBBT22	Biochemistry-I	3	0	0	2	3	40	60	100
MDC 2	24MBBT21	Phytochemistry and Herbal Medicine	3	0	0	2	3	40	60	100
DSE 2 / IDC 2 / Minor 2	24DBBT2-	Discipline Specific Elective – II	4	0	0	2	4	40	60	100
DSC 3 (Lab)	24PBBT21	Practical II - Microbiology	0	0	2	1	1	40	60	100
DSC 4 (Lab)	24PBBT22	Practical III - Biochemistry	0	0	2	1	1	40	60	100
VAC 2	24DVAC21	Communication Skills	2	0	0	1	2	40	60	100
SEC 3	24SSKU21	Soft Skills II	2	0	0	1	2	40	60	100
			21	**-**	**4**	**-**	**23**	**-**	**-**	**-**

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

SEMESTER 3										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 3	24LTAM31/ 24LHIN31/ 24LFRE31	Tamil III / Hindi III / French III	2	0	0	1	2	40	60	100
ENG 3	24LENG31	English III	2	0	0	1	2	40	60	100
DSC 5	24CBBT31	Clinical Diagnostic Techniques	3	0	0	2	3	40	60	100
DSC 6	24CBBT32	Immunology	3	0	0	2	3	40	60	100
MDC 3	24MBBT31	Biophysics and Biostatistics	3	0	0	2	3	40	60	100
DSE 3 / IDC 3 / Minor 3	24DBBT3-	Discipline Specific Elective - III	3	0	0	2	3	40	60	100
DSC 5 (Lab)	24PBBT31	Practical IV – Clinical Diagnostic Technique	0	0	2	1	1	40	60	100
DSC 6 (Lab)	24PBBT32	Practical V - Immunology	0	0	2	1	1	40	60	100
MDE 1		Indian Knowledge System	1	1	0	1	2	40	60	100
SEC 4	24SSKU31	Soft Skills III	2	0	0	1	2	40	60	100
SI 1	24IBBT31	Internship I	0	0	2	1	1	-	100	100
			19	**1**	**6**	**-**	**23**	**-**	**-**	**-**

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

SEMESTER 4										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 4	24LTAM41/ 24LHIN41/ 24LFRE41	Tamil IV / Hindi IV / French IV	2	0	0	1	2	40	60	100
ENG 4	24LENG41	English IV	2	0	0	1	2	40	60	100
AECC 1	24EVS041	Environmental Studies	3	0	0	2	3	40	60	100
DSC 7	24CBBT41	Plant Biotechnology	3	0	0	2	3	40	60	100
DSC 8	24CBBT42	Animal Biotechnology	3	0	0	2	3	40	60	100
DSE 4 / IDC 4 / Minor 4	24DBBT4-	Discipline Specific Elective -IV	4	0	0	2	4	40	60	100
DSC 7 (Lab)	24PBBT41	Practical V – Plant Biotechnology	0	0	2	1	1	40	60	100
DSC 8 (Lab)	24PBBT42	Practical VI – Animal Biotechnology	0	0	2	1	1	40	60	100
SEC 5	24SBBT41	Industry Oriented Employability skills	1	0	2	1	2	40	60	100
VAC 3	24DVAC41	Yoga Education / NSS / NCC	0	0	2	1	1	-	100	100
SEC 6		In-plant Training/ Industrial Tour/ Summer Term	-	-	-	-	-	-	-	-
			18	**-**	**8**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

SEMESTER 5										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 9	24CBBT51	Bio fermentation and Downstream Processing	3	0	0	2	3	40	60	100
DSC 10	24CBBT52	Genetic Engineering	4	0	0	2	4	40	60	100
DSE 5 / IDC 5 / Minor 5	24DBBT5-	Discipline Specific Elective – V	4	0	0	2	4	40	60	100
DSC 9 (Lab)	24PBBT51	Practical VII - Bio fermentation	0	0	2	1	1	40	60	100
DSC 10 (Lab)	24PBBT52	Practical VIII – Genetic Engineering	0	0	2	1	1	40	60	100
MDE	24EMDE51	Cyber Security	3	0	0	2	3	40	60	100
SEC 7	24SBBT51	Entrepreneurial Development	2	0	0	1	2	40	60	100
VAC 4	24DVAC51	Mushroom Cultivation	2	0	0	1	2	40	60	100
SI 2	24IBBT51	Internship II	0	0	2	1	1	-	100	100
SEC 8		Skill Enhancement Training / Student Club Activities/ Institution Innovation Council Activities	-	-	-	-	-	-	-	-
			18	**-**	**6**	**-**	**21**	**-**	**-**	**-**

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

SEMESTER 6										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 12	24CBBT61	Bioinformatics	3	0	0	2	3	40	60	100
DSC 13	24CBBT62	Stem Cell Biology	4	0	0	2	4	40	60	100
DSC 14	24CBBT63	Microbial Biotechnology	4	0	0	2	4	40	60	100
DSC 15	24CBBT64	Medical Coding and Clinical Research	4	0	0	2	4	40	60	100
DSE 6 / IDC 6 / Minor 6	24DBBT6-	Discipline Specific Elective – VI	3	0	0	2	3	40	60	100
DSC 12 (Lab)	24PBBT61	Practical IX - Bioinformatics	0	0	2	1	1	40	60	100
SEC 9	24SBBT61	Mini Project	0	0	4	1	2	-	100	100
SEC 10		On Job Training / Apprenticeship / Startup	-	-	-	-	-	-	-	-
			18	**-**	**6**	**-**	**21**	-	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

SEMESTER 7										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 16	24CBBT71	Pharmaceutical Biotechnology	3	0	0	2	3	40	60	100
DSC 17	24CBBT72	Omics Technology	4	0	0	2	4	40	60	100
DSC 18	24CBBT73	Tissue Engineering	4	0	0	2	4	40	60	100
DSE 7 / IDC 7 / Minor 7	24DBBT7-	Discipline Specific Elective – VII	4	0	0	2	4	40	60	100
DSC 16 (Lab)	24PBBT71	Practical X - Pharmaceutical Biotechnology	0	0	2	1	1	40	60	100
RP 1	24RBBT71	Research Project I	0	0	12	4	6	40	60	100
			15	**-**	**14**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

SEMESTER 8										
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 19	24CBBT81	Food Biotechnology	3	0	0	2	3	40	60	100
DSC 20	24CBBT82	Marine Biotechnology	3	0	0	2	3	40	60	100
DSC 21	24CBBT83	Research Methodology	4	0	0	2	4	40	60	100
DSE 8 / IDC 8 / Minor 8	24DBBT8-	Discipline Specific Elective -VIII	4	0	0	2	4	40	60	100
DSC 19 (Lab)	24PBBT81	Practical XI – Food Biotechnology	0	0	2	1	1	40	60	100
DSC 20 (Lab)	24PBBT82	Practical XII – Marine Biotechnology	0	0	2	1	1	40	60	100
RP 2	24RBBT81	Research Project II	0	0	12	4	6	-	60	100
			14	**-**	**16**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study, *C - Credits**

DISCIPLINE SPECIFIC CORE COURSES

Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**
DSC 1	24CBBT11	Cell Biology and Genetics	3	0	0	2	3
DSC 2	24CBBT12	Molecular Biology	4	0	0	2	4
DSC 1 (Lab)	24PBBT11	Practical I - Cell Biology, Genetics	0	0	2	1	1
DSC 3	24CBBT21	Fundamentals of Microbiology	3	0	0	2	3
DSC 4	24CBBT22	Biochemistry-I	3	0	0	2	3
DSC 3 (Lab)	24PBBT21	Practical II - Microbiology	0	0	2	1	1

DSC 4 (Lab)	24PBBT22	Practical III - Biochemistry	0	0	2	1	1
DSC 5	24CBBT31	Clinical Diagnostic Techniques	3	0	0	2	3
DSC 6	24CBBT32	Immunology	3	0	0	2	3
DSC 5 (Lab)	24PBBT31	Practical IV – Clinical Diagnostic Technique	0	0	2	1	1
DSC 6 (Lab)	24PBBT32	Practical V - Immunology	0	0	2	1	1
DSC 7	24CBBT41	Plant Biotechnology	3	0	0	2	3
DSC 8	24CBBT42	Animal Biotechnology	3	0	0	2	3
DSC 7 (Lab)	24PBBT41	Practical VI – Plant Biotechnology	0	0	2	1	1
DSC 8	24PBBT42	Practical VII –	0	0	2	1	1
(Lab)		Animal Biotechnology					
DSC 9	24CBBT51	Bio fermentation and Downstream Processing	3	0	0	2	3
DSC 10	24CBBT52	Genetic Engineering	3	0	0	2	3
DSC 11	24CBBT53	Human Physiology and Developmental Biology	4	0	0	2	4
DSC 9 (Lab)	24PBBT51	Practical VIII - Bio fermentation	0	0	2	1	1
DSC 10 (Lab)	24PBBT52	Practical IX – Genetic Engineering	0	0	2	1	1
DSC 12	24CBBT61	Bioinformatics	3	0	0	2	3
DSC 13	24CBBT62	Stem Cell Biology	4	0	0	2	4
DSC 14	24CBBT63	Microbial Biotechnology	4	0	0	2	4

DSC 15	24CBBT64	Medical Coding and Clinical Research	4	0	0	2	4
DSC 12 (Lab)	24PBBT62	Practical X - Bioinformatics	0	0	2	1	1
DSC 16	24CBBT71	Pharmaceutical Biotechnology	3	0	0	2	3
DSC 17	24CBBT72	Omics Technology	3	0	0	2	3
DSC 18	24CBBT73	Tissue Engineering	4	0	0	2	4
DSC 16 (Lab)	24PBBT71	Practical XI - Pharmaceutical Biotechnology	0	0	2	1	1
DSC 19	24CBBT81	Food Biotechnology	3	0	0	2	3
DSC 20	24CBBT82	Marine Biotechnology	3	0	0	2	3
DSC 21	24CBBT83	Research Methodology	4	0	0	2	4
DSC 19 (Lab)	24PBBT81	Practical XII – Food Biotechnology	0	0	2	1	1
DSC 20 (Lab)	24PBBT82	Practical XIII – Marine Biotechnology	0	0	2	1	1

KNOWLEDGE IS POWER

DISCIPLINE SPECIFIC ELECTIVE COURSES

Category	Code	Course	L	T	P	O	C
DSE 1	24DBBT11	Good Laboratory Practice	4	0	0	2	4
	24DBBT12	Skills in Biotechnology	4	0	0	2	4
DSE 2	24DBBT21	Environmental Biotechnology	4	0	0	2	4
	24DBBT22	Bioinstrumentation	4	0	0	2	4
DSE 3	24DBBT31	Enzyme Technology	3	0	0	2	3
	24DBBT32	Biodiversity and Ecology	3	0	0	2	3
DSE 4	24DBBT41	IPR & Bioethics	4	0	0	2	4
	24DBBT42	Clinical Research	4	0	0	2	4
DSE 5	24DBBT51	Nanobiotechnology	4	0	0	2	4
	24DBBT52	Biochemistry – II	4	0	0	2	4
DSE 6	24DBBT61	Biomedical Waste Management	3	0	0	2	3
	24DBBT62	Agricultural Biotechnology	3	0	0	2	3
DSE 7	24DBBT71	Management Principles in Biotechnology Industry	4	0	0	2	4
	24DBBT72	Biotechnology for Human Welfare	4	0	0	2	4
DSE 8	24DBBT81	Drug Designing	4	0	0	2	4
	24DBBT82	Entrepreneurship Development in Biotechnology	4	0	0	2	4

AECC & LANGUAGES

Category	Code	Course	L	T	P	O	C
LANG 1	24LTAM11/ 24LHIN11/ 24LFRE11	Tamil I / Hindi I/ French I	2	0	0	1	2
ENG 1	24LENG11	English I	2	0	0	1	2
LANG 2	24LTAM21/ 24LHIN21/ 24LFRE21	Tamil II / Hindi II / French II	2	0	0	1	2
ENG 2	24LENG21	English II	2	0	0	1	2
LANG 3	24LTAM31/ 24LHIN31/ 24LFRE31	Tamil III / Hindi III / French III	2	0	0	1	2
ENG 3	24LENG31	English III	2	0	0	1	2
LANG 4	24LTAM41/2 4LHIN41/ 24LFRE41	Tamil IV / Hindi IV/ French IV	2	0	0	1	2
ENG 4	24LENG41	English IV	2	0	0	1	2
AECC 1	24EVS041	Environmental Studies	3	0	0	2	3

MULTIDISCIPLINARY COURSES

Category	Code	Course	L	T	P	O	C
MDC 1	24MBBT11	Nutrition and Health	3	0	0	2	3
MDC 2	24MBBT21	Phytochemistry and Herbal Medicine	3	0	0	2	3
MDC 3	24MBBT31	Biophysics and Biostatistics	3	0	0	2	3

MULTIDISCIPLINARY ELECTIVES

Category	Code	Course	L	T	P	O	C
MDE 1	24EMBE31	Indian Knowledge System	1	1	0	1	2
MDE 2	24EMBE51	Cyber Security	3	0	0	2	3

VALUE ADDED COURSES

Category	Code	Course	L	T	P	O	C
VAC 1	24DVAC11	Universal Human Values	1	0	0	1	1
VAC 2	24DVAC21	Communication Skills	2	0	0	1	2
VAC 3	24DVAC41	Yoga Education / NSS / NCC	0	0	2	1	1

VAC 4	24DVAC51	Mushroom Cultivation	2	0	0	1	2

SKILL ENHANCEMENT COURSES

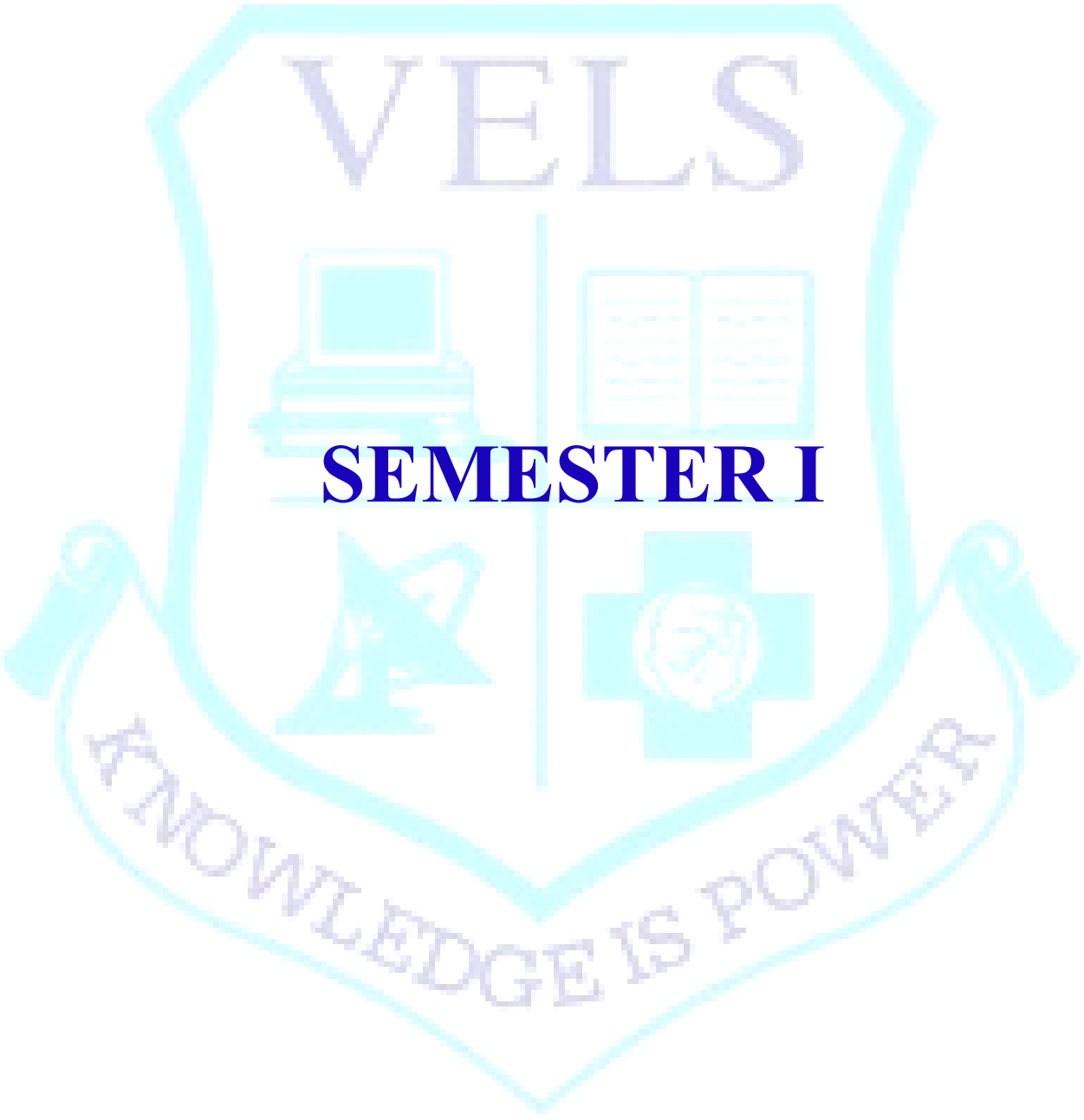
Category	Code	Course	L	T	P	O	C
SEC 1	24SSKU11	Soft Skills I	2	0	0	1	2
SEC 2		Orientation Programme / Industrial Visit	-	-	-	-	-
SEC 3	24SSKU21	Soft Skills II	2	0	0	1	2
SEC 4	24SSKU31	Soft Skills III	2	0	0	1	2
SEC 5	24SBBT41	Industry Oriented Employability skills	1	0	2	1	2
SEC 6		In-plant Training/ Industrial Tour/ Summer Term	-	-	-	-	-
SEC 7	24SBBT51	Entrepreneurial Development	2	0	0	1	2
SEC 8		Skill Enhancement Training / Student Club Activities/ Institution Innovation Council Activities	-	-	-	-	-
SEC 9	24SBBT61	Mini Project	0	0	4	1	2
SEC 10		On Job Training / Apprenticeship / Startup	-	-	-	-	-

SUMMER INTERNSHIP

Category	Code	Course	L	T	P	O	C
SI 1	24IBBT31	Internship I	0	0	2	1	1
SI 2	24IBBT51	Internship II	0	0	2	1	1

RESEARCH PROJECT

Category	Code	Course	L	T	P	O	C
RP 1	24RBBT71	Research Project I	0	0	12	4	6
RP 2	24RBBT81	Research Project II	0	0	12	4	6



SEMESTER I

24LTAM11 மொழிவரலாறு - சங்க இலக்கியம் – அற இலக்கியம் - மொழித்திறன்

L	T	P	O	C
2	0	0	1	2

பருவம்-1, தமிழ்மொழிப்பாடம்-1, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2. தாள்-1

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், தற்கால தமிழ் இலக்கிய வகைமைகளான மரபுக்கவிதை, புதுக்கவிதை, உரைநடை ஆகியவற்றை அறிமுகப்படுத்துதல், தமிழர்தம் வாழ்வியல் நெறிகளையும் பண்பாட்டுச் செழுமைகளையும் இன்றைய தலைமுறையினர் அறியச் செய்தல், மாணவர்களுக்குத் தமிழைத் தவறின்றி எழுதுவதற்குத் தேவையான பயிற்சி அளித்து அவர்களின் மொழித்திறனை மேம்படுத்துதல், செய்யுளின் நலத்தைப் பாராட்டும் முறைமையை அறியச் செய்து அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களுக்கு வேலைவாய்ப்பை உருவாக்குவதும் இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு- 1: தமிழ் மொழி வரலாறு 8மணி நேரம்

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 8 மணி நேரம்

புறநானூறு- பாடல் எண்: , 182, 183, – இரண்டு பாடல்கள்.

குறுந்தொகை- பாடல் எண்: 2, 167, - இரண்டு பாடல்கள்

பரிபாடல் - முருகன். வையை - இரண்டு பாடல்கள்

அலகு - 3 அற இலக்கியங்கள் **07 மணி நேரம்**

திருக்குறள்- வான்சிறப்பு (அறம்), பெருமை (பொருள்), பிரிவாற்றாமை (இன்பம்), மூன்று அதிகாரங்கள் முழுமையும்

1. நாலடியார் - இரண்டு பாடல்கள். (2, 3)
2. மூதுரை - இரண்டு பாடல்கள். (2, 8)

அலகு 4 மொழி **07 மணி நேரம்**

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

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

1. தமிழர் நாகரிகமும் பண்பாடும், டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. தவறின்றித் தமிழ் எழுதுவோம், மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. தவறின்றித் தமிழ் எழுத - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. தமிழ் இலக்கிய வரலாறு, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. புதிய தமிழ் இலக்கிய வரலாறு, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. செம்மொழி தமிழின் சிறப்பியல்புகள் - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. பாடநூல் தேடலுக்கான இணையம் - https://archive.org/

24LHIN11 **वर्ष I – सत्र I (गद्य, पत्र लेखन & व्यावहारिक हिन्दी)**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

- To understand the rural life style, social responsibilities and social values
- To create awareness about the importance of varied culture
- To enable the students to develop communication skill in Hindi and to use Azhagi,
- Azhagi+ fonts

UNIT I: पं.श्रीराम शर्मा कृत 'स्मृति' (कहानी)

'Smruti' (Kahani) by Pandit Sriram Sharma. 6hrs.

UNIT II: शरद जोशी कृत 'अतिथि तुम कब जावोगे' (व्यंग्य)

'Athiti tum kab jaaoge' (Vyangy) by Sharad Joshi. 6hrs.

UNIT III: राहुल सांस्कृतयायन कृत 'अथातो घुमक्कड़ जिज्ञासा'(यात्रा वृत्तान्त)

'Atatho Ghumakkad Jigyasa' (Yatra Vruthanth) by Rahul Sanskrityayan. 6hrs.

UNIT IV: व्यावहारिक हिन्दी- पत्र लेखन में प्रयुक्त वाक्यांश, कौशल विकास – भाव एक भाषा अनेक

Functional Hindi-Phrases used in Letter Writing.
Skill development - Bhav Ek Bhasha Anek 6hrs.

UNIT V: पत्र लेखन – परिचय व प्रकार, 3 अनोपचारिक पत्र अलगी, अलगी + फ़ॉन्ट का परिचय

Letter Writing- Intro. & Types & 3 Personal Letters
Introduction to Azhagi, Azhagi + fonts 6hrs.

Total: 30hrs.

COURSE OUTCOME:

At the end of this course Students will be able to

CO1: Gain knowledge about the rural life style

CO2: Understand social values

CO3: Understand importance of varied culture

CO4: Journalise in Functional Hindi

CO5: Use Azhagi, Azhagi+ fonts

TEXT BOOKS:

1. Pandit Shriram Sharma, Shikaar, Sahitya (1932), Sadan.

2. Sharad Joshi, Yatha Sambhav (2014), Bharatiya Gyanpeet.
3. Rahul Sanskrityayan, Ghumakkad Shastra (1949), Rajkamal Prakashan.

REFERENCE BOOK:

1. Kendriya Hindi Sansthan (2012), Banking Hindi Patyakram.
2. NCERT, Sparsh, Class 9.
3. Main Aur Mera Vyakaran, New Saraswati House, New Delhi.
4. Govind Ballabh Sharma (2022), Hindi Vyavaharik Tankan Kala Evam Tankan Abhyas, Neelkanth Publishers Pvt. Ltd.

WEBLINKS:

1. Pandit Sriram Sharma ka kahani: https://www.evidyarthi.in
2. Harishankar parasayi ka Vyangy: http://gadyakosh.org
3. Rahul Sanskrityayan ka yatravruttant: https://www.hindwi.org
4. Prayojanmoolak Hindi:https://hi.mwikipedia.org
5. https://www.azhagi.com/hnd/helphtml/Introduction.html

24LFRE11 **FRENCH PAPER 1**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

The lessons are being chosen:

- to greet, to express excuse and to introduce oneself
- to introduce another person
- to express his/her ideas, opinions and weekend projects
- to request someone to do something, polite manners
- to accept, refuse, enquire and indicate the time and date
- to express himself / herself in positive and negative manner

UNIT 1 Salut 4 hours

les nombres, Les jours de la semaine et du mois, La nationalité

UNIT 2 Enchanté 6 hours

Les verbes Etre, Avoir, Aller, Regular ER verbes, Present tense.

UNIT 3 J'Adore 4 hours

La negation, l'adjectif possessif, le futur proche

UNIT 4 Tu veux bien 7 hours

Les articles de finis/indéfinis, Les pronoms après une préposition (avec lui, chez moi),
Le passé composé

UNIT 5 On se voit quand 5 hours

Les pronoms compléments directs me, te, nous, vous, L'interrogation avec est-ce que,
L'heure et

UNIT 6 Bonne idée 4 hours

Les articles partitifs, Le masculin et le féminin des adjectifs, Les pronoms compléments directs le, la, les, La négation : ne… pas de.

Total hours - 30 hours

COURSE OUTCOME:

- The students would be able to greet, to excuse and to introduce himself
- The students would be able to introduce someone
- The students would be able to express his ideas, opinions and weekend projects
- The students would be able to ask someone to do something, polite manner
- The students would be able to accept, refuse enquire and indicate the time and date
- The students would be able to express himself in positive and negative manner

TEXT / REFERENCE BOOK:

Prescribed book: LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

Reference book: SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

24LENG11 ENGLISH - I

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

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

UNIT I - PROSE 06

- Dangers of drug abuse - Hardin B.Jones
- Tight corners - E.V.Lucas

UNIT II -POETRY 06

- Ecology - A.K.Ramanujan
- The owl and the chimpanzee - Jo Camacho

UNIT III - SHORT STORY 06

- The Dear Departed - Stanley Houghton
- The Fool's Paradise- Isaac Bashevis Singer

UNIT IV -GRAMMAR 06

- Parts of speech, Articles

UNIT V -GRAMMAR 06

- One-word substitution, prefix, suffix, synonym, antonym.

Total: 30 hours

Course Outcomes:

At the end of this course, the students would have learnt to

CO1	understand the characteristic features of the language used in the text.
CO2	strengthen their knowledge of basic grammar
CO3	improve narrative skills after studying diverse prose and play.
CO4	understand to classify parts of speech and articles.
CO5	develop critical writing skills in the textual content of the syllabus.

References:

- English for Communication Enrichment: by Jeya Santhi June 2015.
- Dr. M. Narayana Rao and Dr. B. G.Barki (2012) – Anu's Current English for Communication (Anu Chitra).
- Dr. R. Ananthan (2010) Effective Communication. Ed. Chennai: Anu Chithra Publication.

24CBBT11 *CELL BIOLOGY & GENETICS*

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To provide knowledge about the structure and functions of various cells and the fundamental aspects of Genetics.

UNIT-I INTRODUCTION OF CELLS AND ORGANELLES **10**

An overview of Plant and Animal Cells. Structure and Organization of prokaryotic and eukaryotic cells. Structural organization and function of intracellular organelles (Nucleus, Endoplasmic Reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes and vacuoles), cytoskeleton.

UNIT II CELL WALL AND MEMBRANE **9**

Plasma membrane - model of plasma membrane; fluidity of membranes; Membrane proteins and their functions; Transport across the membrane - selective permeability of membrane, Hierarchical structure of protein, folding, modification, sorting and degradation of protein, functional design of proteins.

UNIT III CELL DIVISION AND REGULATION **8**

Cell division, cell cycle: Mitosis, Meiosis and their regulation, Cell signalling molecules and their receptors.

UNIT IV PRINCIPLES OF GENETICS **10**

Principles of Mendelian inheritance – Incomplete dominance – Multiple alleles – Linkage, crossing over – Genetic mapping – Recombination – Polygenic inheritance – Extra chromosomal inheritance – Sex chromosomes – Sex linked inheritance – Mutation types – Chromosomal aberrations – Syndromes.

UNIT V GENE TRANSFER MECHANISM **8**

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

Total: 45 Hours

Course Outcome:

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

CO-1: Understand the molecules of life and analyze the sub-cellular organelles and its functions.

CO-2: Learn about the detailed membrane organization and its functions in living cell.

CO-3: Knowledge about cell division and regulation.

CO-4: Idea on fundamentals of genetics and mendelian concepts.

CO-5: Knowledge about chromosome, mutation and its mechanism.

CO-6: Understand the concept of gene transfer mechanism**.**

CO-7 Learn about the Operon concept in prokaryotic organisms.

Text and Reference Books:

1. P.K. Gupta, (2013) Cell and Molecular Biology, Rastogi Publications.
2. S.C. Rastogi, (2011) Cell Biology, New Age International Publishers.
3. C. Nalini, V. Susan, (2012) Cell and Molecular Biology, Wolters Kluwer (India) Pvt. Ltd. New Delhi.
4. P.S. Verma, and V. K. Agarwal, (2008). "Cell Biology". S. Chand Publication.
5. T.D. Pollard, and C.Earnshaw, (2008) "Cell Biology". 2nd Edition.
6. H. Lodish, A. Berk, K. Kaiser, Scott, P. Bretscher, and P. Matsudaria, (2008) "Molecular Cell Biology". Media connected, W. H. Freeman and company, 6th edition.
7. G. M. Cooper, and R.E. Hausman, (2007) "The Cell". Molecular approach. A.S.M press. 4th edition.
8. S. Chand and P.S. Verma, (2006) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand Publishing.
9. G. Eldon John, J. Michael, D. Simmons, S. Peter (2012) Principles of Genetics, 8th edition, John Wiley and Sons.
10. T. Robert, (2010) Principles of Genetics, 7th edition, Tata McGraw Hill publishing.

24CBBT12 *MOLECULAR BIOLOGY*

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

To provide knowledge on genome organization, central dogma of molecular biology and regulation of gene expression.

UNIT I GENOME ORGANISATION **10**

Organization of genetic material in prokaryotes and eukaryotes - Structure of chromatin - nucleosomes, histones. DNA as a genetic material - Watson & Crick model. Nucleic acids - structure and function of DNA and RNA - biological significance of DNA and RNA.

UNIT II DNA REPLICATION **13**

Central Dogma of Molecular Biology, DNA replication – Types of DNA polymerases - Mechanism of DNA replication - Enzymes and accessory proteins involved in DNA replication. Differences in prokaryotic and eukaryotic DNA replication.

UNIT III GENE EXPRESSION **13**

Gene as the unit of expression. Types of RNA (mRNA, tRNA and rRNA). Transcription in prokaryotes and eukaryotes - Mechanism of transcription, RNA polymerase - post transcriptional modifications.

UNIT IV TRANSLATION **12**

Translation - prokaryotes and eukaryotes, Elucidation of Genetic code, translational machinery, mechanism of initiation, elongation and termination - Post translational modifications.

UNIT V REGULATION OF GENE EXPRESSION **12**

Regulation of gene expression in prokaryotes and eukaryotes- the operon concept. Types of Promoters, Role of Enhancers, Cis-trans elements, DNA methylation and Chromatin remodeling in gene expression. Environmental regulation of gene expression.

Total: 60 Hours

Course Outcome:

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

CO-1: Learn the concept of the structure and function of DNA and RNA.

CO-2: Understand the concept of central dogma of Molecular Biology

CO-3: Compare the Prokaryote and eukaryote DNA replication and mechanism

CO-4: Understand the concept of gene expression.

CO-5: Determine genetic code, translation and modification mechanism

CO-6: Illustrate on post-modification after transcription and Translation.

CO-7: Adapt the knowledge about the regulation of gene expression.

CO-8: Understanding of promoters and Enhancers.

Text and Reference Books:

1. H. Lodish, Baltimore. B. Arnold et al. (2011) "Molecular cell biology" 7th edition. Publisher: W. H. Freeman.
2. E.D.P De Robertis, E.M.F Robertis, (2006) Cell and molecular biology, Saunders Company.
3. D. Freifielder, (2009) "Molecular Biology", 3rd edition Jones & Bartlett publications.
4. M. Cooper, (2004) "The Cell Molecular Approach", ASM Press.
5. W. Work, (1976) Laboratory Techniques in Biochemistry and Molecular Biology. Vol 5. American Elsevier, NewYork.
6. A. Bruce, D. Bray, J. Lewis, M. Raff, Roberts and J.D. Watson, (1994) Molecular Cell Biology, II Edition, Garland Publishing Inc., New York.
7. J. D. Watson, N.H. Hopkins, J.W. Roberts, J. Steitz and A.M. Weiner, (1987) Molecular Biology of Gene. IV Edition, The Benjamin Cummings Publishers Inc., California.

24MBBT11 *NUTRITION AND HEALTH*

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To understand the nutritional components of food, their synthesis and disorders related to them and prepare a healthy plan. Address nutritional disorders.

UNIT I INTRODUCTION TO NUTRITION AND ENERGY VALUE **9**

Basic concepts of Nutrition; Importance of nutrition and dietetics; Assessment of nutritional value – energy value of carbohydrates, proteins, fiber, and fats; Protein efficiency ratio – Net protein utilization and determination; Recommended Dietary Allowances for energy

UNIT II BIOMOLECULES AS NUTRIENTS **9**

Carbohydrate, Protein, and Lipids – Functions, Sources, RDA, Biochemical function and deficiency disorder.

UNIT III VITAMINS AND MINERALS AS NUTRIENTS **9**

Fat soluble and water-soluble vitamins – Functions, source, RDA, deficiency disorder. Minerals – General Functions and Classification. Macro and Micro minerals – functions, source, RDA, absorption, deficiency and toxicity.

UNIT IV NUTRITIONAL DISORDERS **9** Naturally occurring anti-nutritional factors – Cyanogen, Lectins Lifestyle related diseases – Cardiovascular, hypertension and Obesity; Other Diseases - Cancer, Diabetes.

UNIT V HEALTH DIET **9**

Balanced Diet; Preparation of a healthy diet; Health Indices; Prevention of Nutrition related disorders; Healthy Lifestyle; Food related Laws and regulations – Food safety (FSSAI); Government Initiatives to improve nutritional health – POSHAN, Mid-day meals, etc.,

Total: 45 Hours

Course Outcome:

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

CO-1: Understand the basic nutritional components of food.

CO-2: Elaborate on the Recommended Dietary Allowances for energy and nutrition.

CO-3: Evaluate the energy contribution of various nutrients.

CO-4: Explain the synthesis of different nutrients.

CO-5: Analyze the disorders related to nutritional deficiency and lifestyle.

CO-6: List out the Food related Laws and regulations for Food safety (FSSAI)

CO-7: Address nutritional deficiency and assess government efforts to improve public health.

Text and Reference Books:

1. Whitney E., S. Rady Rolfes (2010). Understanding Nutrition. 11th edition. Thompson Wadsworth.
2. Mc Guire Michelle, A. Kathy, (2013) Nutritional Sciences- From Fundamentals to Food. 2nd edition Thompson Wadsworth.
3. Lehninger, Nelson, Cox – Principles of Biochemistry, CBS Publications
4. M.L. Wahlquist (1997) Food and Nutrition.
5. M. Eastwood, (2013) Principles of Human nutrition – 2nd edition, Blackwell Publications

24PBBT11 PRACTICAL I: CELL BIOLOGY AND GENETICS

L	T	P	O	C
0	0	2	1	1

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

LIST OF EXPERIMENTS:

1. Compound Microscope: Parts, Functions, and Applications
2. Micrometry: Working principle and applications
3. Identification of given prokaryotic (microbes) and eukaryotic (plant/animal cells) cells by microscope
4. Identification of differences between the given plant and animal cells
5. Staining Microscopic Specimens: Simple and differential staining
6. Preparation and staining of peripheral blood smear (Giemsa/Leishman's Staining)
7. Buccal smear Preparation– Identification of Barr Body
8. Observation of mitosis cell division in onion root tip.
9. Observation of meiosis cell division in onion flower bud
10. Observation of Embryo development stages: Different stages of Chick embryo developmental stage 48 hrs, 72 hrs and 96 hrs. (Permanent slide)

Total: 30 Hours

Course Outcome:

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

CO-1: Understand the basic Microscope principle, application and handling techniques

CO-2: Identification of different types of cells using microscopic examination.

CO-3: Analyzing plant, animal and microbial cell structures using different staining methods

CO-4: Interpret the pedigree analysis of family genetic history and Karyotyping for chromosomal abnormalities.

CO-5: Compare the different stages of embryonic development.

Text and Reference Books:

1. J. E. Celis, (1997) “Cell Biology: A Laboratory Handbook”, Academic Press.
2. P. Gunasekar, (1995). “Laboratory Manual in Microbiology”. New Age International Private Ltd. Publishers, New Delhi, Chennai.
3. M. Prakash, C.K. Arora, (1998) “Biochemical techniques”, Anmol Publications (I) Ltd New Delhi.
4. R. Majumdar, R. Sisodia (2018). “Laboratory Manual of Cell Biology”
5. T. David Plummer (2006) “An Introduction to Practical Biochemistry”, Tata McGraw Hill Publishing Company Ltd. New Delhi. 3rd Edition, 2006
6. K. V. Chaitanya, (2013) “Cell and Molecular Biology: A Lab Manual”, PHI, 2013.
7. Dr. Athar Hussain (2018) Shah “Laboratory Manual Cell Biology Genetics and Evolution” Ilmi Kitab Khana.

L	T	P	O	C
1	0	0	1	1

24DVAC11 UNIVERSAL HUMAN VALUES

COURSE OBJECTIVE:

The candidates will be able to appreciate the complementarity between the values and skills for sustained happiness and prosperity. To influence the students to approach the life and profession with a holistic perspective towards a value-based living in a natural way. To highlight plausible implications of holistic understanding of ethical human conduct.

UNIT- I INTRODUCTION TO VALUE EDUCATION 5

Living a fulfilling life. Value education. Skill education. Complementarity of Values and Skills. Development of a holistic perspective. Right understanding, relationship and physical facility. Understanding the happiness and prosperity.

UNIT-II HARMONY AT MULTIPLE LEVELS 5

Human being as co-existence of the self and the human body. Understanding harmony in the self. Harmony in the family and understanding values in human-human relationships. Harmony in the society and understanding universal human order. Harmony in nature and understanding the interconnectedness, self-regulation and mutual fulfillment. Harmony in existence and understanding co-existence at various levels.

UNIT-III IMPLICATIONS OF THE RIGHT UNDERSTANDING 5

Ethical human conduct. Implications of value-based living. Right understanding of professional ethics. Humanistic education. Holistic technologies, production systems and management models. Strategies for transition towards value-based life and profession.

Total: 15 Hours

Course Outcome:

At the end of the course learners will be able to:

CO1: Develop qualities like responsibility and the ability to handle problems with sustainable solutions.

CO2: Appraise human values and the harmony at various levels.

CO3: Perceive a better critical ability.

CO4: Develop qualities pertaining to value-based living.

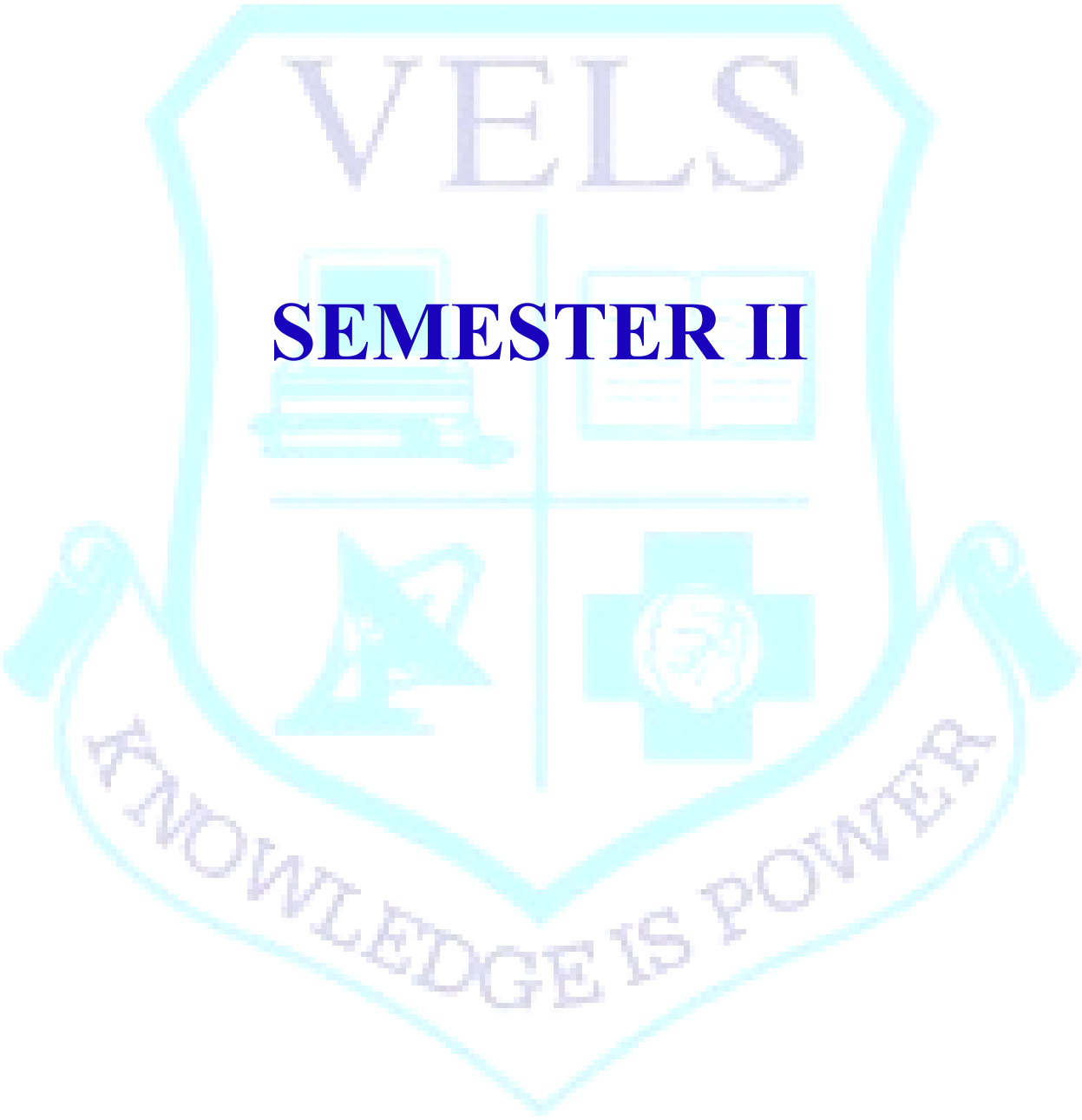
CO5: Apply what they have learnt to their own self in real life settings.

Text Books:

1. R.R. Gaur, R. Asthana, G.P. Bagaria. (2023). A Foundation Course in Human Values and Professional Ethics. 3rd Revised Edition. Excel Books, New Delhi.

Reference Books:

1. A. Nagaraj, Jeevan Vidya Prakashan, Amar Kantak. Jeevan Vidya: Ek Parichaya . (1999).
2. Rakesh Gupta. (2008). Jeevan Vidya: An Introduction (Introductory Book to Madhyasth Darshan-Coexistentialism). English Version.
3. A. N. Tripathi. (2004). Human Values. First Edition. New Age International Publishers, New Delhi.



SEMESTER II

24LTAM21 காப்பியம், பக்தி இலக்கியம், கலைகள், நாகரிகம்-பண்பாடு

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பருவம்-2, தமிழ்மொழிப்பாடம்-2, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2. தாள்-2

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், அற இலக்கியங்கள், சிற்றிலக்கியம், சிறுகதை ஆகியவற்றை அறிமுகப்படுத்துதல், தற்காலப் பேச்சுத் தமிழ் எழுத்துத்தமிழ் ஆகியவற்றின் வளர்நிலைகளை மாணவர்களை அறியச் செய்தல், அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களின் மொழித் திறனை மேம்படுத்த அவர்களுக்குக் கடிதம் எழுதும் கலையைக் கற்றுக்கொடுத்தல், அணி இலக்கணத்தை அறியச் செய்தல் என்பன இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1 காப்பியங்கள் 8மணி நேரம்

சிலப்பதிகாரம்- கனாத்திறம் உரைத்தக் காதை முழுவதும்.

மணிமேகலை- மலர்வனம் புக்க காதை முழுவதும்.

கம்பராமாயணம் - குகப் படலம் (தேர்ந்தெடுக்கப்பட்ட ஒன்பது பாடல்கள்)

அலகு 2: பக்தி இலக்கியம் 8 மணி நேரம்

1. மாணிக்கவாசகர் – திருவாசகம் – மூன்று பாடல்கள்
   - ✓ புல்லாகி பூடாகி (சிவபுராணம்)
   - ✓ எல்லாப் பிறப்பும் (சிவபுராணம்)
   - ✓ உற்றாரை யான் வேண்டேன் (திருப்புலம்பல்)
2. ஆண்டாள் – திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)
   - ✓ மார்கழித் திங்கள் … (பாசுரம் 1)
   - ✓ ஓங்கி உலகளந்த… (பாசுரம் 3)
   - ✓ ஆழிமழைக் கண்ணா… (பாசுரம் 4)
3. வீரமாமுனிவர் – தேம்பாவணி – வளன் சினித்தப் படலம்
4. சீறாப்புராணம்- மானுக்கு பிணை நின்ற படலம்

அலகு 3 கலைகள் 7 மணி நேரம்

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

அலகு 4 நாகரிகம், பண்பாடு 7மணி நேரம்

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

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.

2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம்** - https://archive.org/

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24LHIN21 **वर्ष I - सत्र II (गद्य, पत्र लेखन & व्यावहारिक हिन्दी)**

I Year-Sem II (Prose, Official Letter Writing & Functional Hindi)

COURSE OBJECTIVES:

- To inculcate the human values, importance of patriotism and hard work
- To train students in functional Hindi
- To introduce the usage of Inscript keyboard

UNIT I: मुंशी प्रेमचंद कृत 'बूढी काकी '(कहानी)
'Boodee kaki" (Kahani) by Munshi Premchand 6hrs.

UNIT II: जयशंकर प्रसाद कृत 'पुरस्कार' (कहानी)
'Puraskar' (Kahani) by Jaishankar Prasad 6hrs.

UNIT III: हरिशंकर परसाई कृत 'मैं नरक से बोल रहा हूँ' (व्यंग्य)
'Main Narak Se Bhol Raha Hun' (Vyangy) by Harishankar Parsayi, 6hrs.

UNIT IV: व्यावहारिक हिन्दी 1 – 50 – तकनीकि शब्द, 50 – पदनाम व विभागीय नाम, भाव एक भाषा अनेक 6hrs.
Functional Hindi 1 - 50-Technical Words, 50-Designation & Department Names, Bhav Ek Bhasha Anek

UNIT V: व्यावहारिक हिन्दी 2 – पत्र लेखन – 3 औपचारिक पत्र, इन्स्क्रिप्ट कीबोर्ड का परिचय 6hrs.
Functional Hindi 2 -Letter Writing- 3 Official Letters. Introduction to Inscript Keyboard

Total: 30hrs

COURSE OUTCOME:

At the end of this course Students will be able to

CO1 Know to the human values

CO2 Know the importance of patriotism

CO3 Know the value of hard work in human life

CO4 Journalise in Functional Hindi

CO5 Use inscript keyboard

TEXT BOOK:

1. Ed. Subhash chandar, Boodi Kaki by Premchand (2012), Natioonal Book Trust.
2. Jaishankar Prasad, Pratinidhi Kahaniyan, Raj Kamal Prakashan (2015).
3. Harishankar Parsai, Pratinidhi vyangy, Rajkamal, (2007).
4. Kendriya Hindi Prashikshan Sansthan, Parangat, Bharat Sarkar (2015).

REFERENCE BOOK:

1. Kendriya Hindi Sansthan, Banking Hindi Patyakram, (2012).

WEBLINK:

1. Munshi Premchand, Manasarovar, 2007, http://gadyakosh.org
2. Jaishankar Prasad/ http://gadyakosh.org
3. Harishankar Parsai/ https://hindikahani.hindi-kavita.com
4. Prayojanmoolak Hindi: https://hi.mwikipedia.org
5. **https://rajbhasha.gov.in/en/introduction**

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24LFRE21 **FRENCH PAPER II**

COURSE OBJECTIVES:

The lessons are being chosen:

- to express his / her where abouts and to ask seek direction
- to express obligation and restriction
- to describe a place
- to narrate and to question
- to describe someone
- to express his desire and to speak about the futur

UNITS:

UNIT 1 C'est où 5 hours

hoursL'impératif, Les articles contractés au, à la…,

Le passé composé et l'accord du participe passé avec être.

UNIT 2 N'oubliez pas 5 hours

Le pronom relatif Qui, que, où, Les pronoms compléments indirects (me, te, lui, leur…)

UNIT 3Belle vue sur la mer -- 4 hours

Les adjectifs démonstratifs, Y- pronom complément.

UNIT 4 Quel beau voyage!

Les verbes pronominaux, En- pronom complément. 4 hours

UNIT 5joli

L'imparfait, L'imparfait ou le passé composé. 5 hours

UNIT 6 Et après?

Le futur simple, Le subjonctif présent. 7 hours

Total hours- 30 hours

COURSE OUTCOME

- The students would be able to express his/her where about and to ask direction
- The students would be able to express obligation and restriction
- The students would be able to describe a place
- The students would be able to narrate and to question
- The students would be able to describe someone
- The students would be able to express his desire and to speak about the futur

TEXT / REFERENCE BOOK:

Prescribed book: LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

Reference book: SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

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24LENG21 **ENGLISH – II**

COURSE OBJECTIVES:

- To read and understand different types of prose, poetry, and fiction.
- To think critically about texts and express ideas clearly.
- To recognize and discuss key themes and styles in literary works.
- To learn and use grammar rules correctly in writing and speaking.
- To write more effectively by applying grammar and literary techniques.

	Credit Hours
UNIT I -PROSE	6
• If you are wrong, admit it- Dale Garnegie • Words of Wisdom- Chetan Bhaghat	
UNIT II - POETRY	6
• La Belle Dame Sans Merci - John Keats • Ozymandias- P.B.Shelley	
UNIT III – FICTION	6
• The School for Empathy - E.V. Lucas • The Lamb to the Slaughter-Roald Dahl	
UNIT IV – GRAMMAR	6
• Types of sentences, Concord	
UNIT V – GRAMMAR	6
• Tenses, Voices	
	Total: 30 hours

Course Outcome:

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

CO-1 Identify poetic expressions in the course of daily speech

CO-2 Students will develop skills that enable them to communicate effectively in writing

CO-3 Students will develop skills that enable them to communicate effectively in writing

CO-4 Discriminate against different sensibilities in approaching life

CO-5 Strengthen ability to solve life's problems, as highlighted in the selections.

Books prescribed:

1. Dr. M. Narayana Rao and Dr. B. G. Barki Current English for Communication (Anu Chitra). June 2012.
2. General English for competitive examinations by V.Rajagopalan (Mcgraw HillEducation) -2010.

24CBBT21 FUNDAMENTALS OF MICROBIOLOGY

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COURSE OBJECTIVE:

To give an introduction to the history of microbiology and the principles of the processes.

UNIT I HISTORY 9

Introduction to Microbiology - History and scope of Microbiology - Classification of microbes – Numerical taxonomy – Molecular taxonomy – Methods of Microbial identification. Structure and function of the Cellular Components – Viruses, Protozoa, Bacteria, Fungi and Algae.

UNIT II MICROSCOPY 9

Introduction to Microscopy, Types of Microscopy - Simple, Compound, Dark field, Phase contrast, Fluorescence, Electron Microscopy Cytophotometry and Flow cytometry. Fixation and staining - types of stains and dyes. Staining techniques - Simple, Differential and special staining (Endospore, Capsular).

UNIT - III MEDIA 9

Sterilization – Methods of sterilization, types of sterilant - Enumeration of microorganisms - types of culture. Microbial metabolism: common nutrient requirements, nutritional types- types of media (selective and differential media, enrichment media, microbial assay media). Aerobic and anaerobic growth - maintenance and preservation.

UNIT- 4 MICROBIAL PHYSIOLOGY 9

Microbial growth, Growth Curve, growth factors, Impact of environmental factors on growth, microbes- energy production, oxidation, reduction reactions, aerobic and anaerobic.

UNIT-5 MICROBIAL DISEASES 9

Medical microbiology – Pathogenic microbes – Bacterial, Viral, Fungal and Protozoan Diseases - Cure, control and prevention – Antimicrobial chemotherapy –Antibiotics – mode of actions –antimicrobial resistance -tests for sensitivity to antimicrobial agents. Pharmaceuticals (antibiotics, vaccines, etc.) - Application of industrial microbes.

Total: 45 Hours

Course Outcome:

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

CO-1: An introduction to the history and scopes of microbiology, along with their classification and Taxonomy.

CO-2: Explain the methods of basic staining techniques for visualization of microorganisms.

CO-3: Illustrate the different types of microscopes and their working principles.

CO-4: Elaborate on the various sterilization techniques and media for microbes.

CO-5: Understanding about the growth of the microbes.

CO-6: An introduction to medical parasitology, and classification based on pathogenicity.

CO-7: Role of microorganisms in food industry and diseases caused by Microbes.

Text and Reference Books:

1. Ananthanarayan, R and Paniker, C.K.J. (2005), A textbook of microbiology, 7th edition, Orient Longman Ltd.
2. Parija S.C (2009), Textbook ofMicrobiology& Immunology, Elsevier, India.
3. PelczarM.J, Chan ECS, King NR, McGraw – Hill, Jnc.NY (2001), Microbiology- Concepts and Applications, Tata Mac, Graw Hill.
4. Ananthanarayan, R and Paniker, C.K.J. (2005), A textbook of microbiology, 7th edition, Orient Longman Ltd.
5. Pelzar (2000), Microbiology, 5th edition, Tata Mac Graw Hill.
6. Ingraham, J.L. and C.A. Ingraham (2000) Introduction to microbiology, 2nd edition. Brooks/Cole, Thomson Learning, USA.
7. Kathleen Park Talaro and Talaro, A (1999), Foundation in microbiology, 3rd edition, Mac Graw – Hill.
8. Cappucino, J.G and Sharman, N (1999), Microbiology: A laboratory manual, 4th edition. Additional Wesley Longbman, Incorporation.
9. Prescott. L.M., Microbiology (1996), III Edition, Wm. C. Brown Publishers, London.

24CBBT22 **BIOCHEMISTRY I**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To develop understanding and provide scientific basics of the life processes at the molecular level and explain the structure, function and inter-relationships of biomolecules.

UNIT I BIOMOLECULES – CARBOHYDRATES 9

Biomolecules, Biological Buffers, Carbohydrates – classification, epimers and Anomers, optical Isomers, properties – Mutarotation, Structure – Glucose, Fructose, Sucrose, Lactose, Starch, Cellulose, chemical reactions of Glucose, Mucopolysaccharides,

UNIT II BIOMOLECULES – LIPIDS 9

Classification, properties, Structure- Fatty acids, essential fatty acids, Triglycerides, Waxes, eicosanoids, phospholipids, sphingolipids, - Steroids and Sterols, Cholesterol and their Biological functions.

UNIT III BIOMOLECULES – PROTEINS 10

Amino acids – Structure, Classification, Properties – Zwitter Ion, Essential amino acids, and Biological Function, properties, Protein – Structural Organization – Primary, Secondary, Tertiary and Quaternary structures, Salting in and Salting Out, Denaturation and Renaturation

UNIT IV BIOMOLECULES – NUCLEIC ACIDS 8

Nucleic acids – nucleoprotein – Histones, nucleic acids, Structure, Properties, Types of DNA and RNA- mRNA, t RNA and r RNA, genetic code

UNIT V VITAMINS, MINERALS & HORMONES 9

Vitamins and Minerals – Classification, Sources, Biological functions and Deficiency manifestations, Hormones – Classification, Chemical nature, Properties and Functions.

Total: 45 Hours

Course Outcome:

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

CO-1: Understand the importance of carbohydrate structure and functions.

CO-2: Illustrate the structure and biological activity of Lipids

CO-3: Summarize the structural organization and biological functions of proteins.

CO-4: Explain the different properties of the protein.

CO-5: Attain Knowledge of Nucleic acid Structure and Significance.

CO-6: Elaborate on the biological functions of Vitamins and Minerals

CO-7: Understanding of different classes of Hormones and their functions.

Text and Reference Books:

1. Lehninger A.L., Nelson D.L. and Cox M.M (2016), Principles of Biochemistry, CBS publishers and distributers, 7th edition.
2. Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. (1996), Harpers Biochemistry. Appleton and Lange, Stanford, 24th edition.
3. Thomas M. Devlin (2010), Textbook of Biochemistry with clinical correlations. Wiley Liss Publishers, 7th edition.
4. Burtis & Ashwood W.B (1993), Tietz Textbook of Clinical chemistry, Saunders Company, 2nd Edition.
5. Lubert Stryer W.H (2006), Biochemistry. Freeman and company, Newyork, 6th Edition.
6. Donald Voet & Judith G (2010), Voet. Biochemistry. John Wiley and Sons, Inc.4th edition.
7. Rama Rao (2006), Textbook of Biochemistry. UBS Publishers' Distributors Pvt. Limited, 9th edition.
8. Deb (2001), Textbook of Biochemistry. New Central Book Agency (p) Ltd, 9th edition.

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3	0	0	2	3

24MBBT12 PHYTOCHEMISTRY AND HERBAL MEDICINE

COURSE OBJECTIVE:

This course provides an in-depth exploration of the chemical constituents of plants and their applications in herbal medicine. Students will examine the principles of phytochemistry, the identification and analysis of plant compound, and the therapeutic uses of herbal remedies

UNIT I INTRODUCTION TO PHYTOCHEMISTRY AND HERBAL MEDICINE 08

Introduction to Phytochemistry and Scope of Phytochemistry – Historical perspective on Herbal medicine – Pharmacognosy: Study of medicinal plant – Over view of major phytochemical classes.

UNIT II PHYTOCHEMICAL ANALYSIS TECHNIQUES 10

Extraction methods: Different types of extraction method – Solvent Selection and Qualitative method of analysis – Spectroscopic methods: UV-Vis, IR mass spectrometry – Chromatography Technique: TLC and HPLC.

UNIT III MAJOR CLASSES OF PHYTOCHEMICALS 09

Alkaloids: Classification, properties, and its biosynthesis pathway – Terpenoids: Properties, biosynthesis and its biological activity – Phenolic compounds: Types and its biosynthesis pathway.

UNIT IV PHARMACOLOGICAL PROPERTIES OF HERBAL REMEDIES 09

Therapeutic uses: Analgesic, Anti-inflammatory, Anti-microbial, Anticancer – Clinical Evidence and Research methodologies – Herbal formulation and Dosage Form.

UNIT V: TOXICOLOGY, QUALITY CONTROL AND REGULATION 09

Toxicology of herbal products: adverse effects and interactions - Quality Assessment: Authentication, Purity and Stability – Regulatory frameworks: FDA, EMA, WHO guidelines.

Total: 45 Hours

Course Outcome:

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

CO-1: Understand the principle of phytochemistry and its relevance to herbal medicine.

CO-2: Identify major classes of phytochemicals and biological activities.

CO-3: Analyze techniques for the extraction and isolation of phytochemicals

CO-4: Illustrate the techniques used for characterization of plant compounds**.**

CO-5: Explore the pharmacological properties and mechanisms of action of herbal remedies**.**

CO-6: Select the right herbal formulation and storage.

CO-7: Evaluate the safety, efficacy and quality control of herbal products.

CO- 8: Understand the regulatory framework to govern phytochemical studies

Text and Reference Books:

1. J.B. Harborne, Herbert Baxter, and Gerard P. Moss "Phytochemistry and Pharmacognosy: Fundamentals and Applications".
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers& Distribution, New Delhi.
3. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.

24PBBT21 *PRACTICAL II - MICROBIOLOGY*

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVE:

To give an introduction to various microbiological laboratory techniques.

LIST OF EXPERIMENTS:

1. Sterilization Techniques, Sterilization of Media, Glass Wares and Instruments
2. Media Preparation (solid & liquid).
3. Staining Techniques–Gram's staining, Spore Staining, Acid fast, Lactophenol Cotton Blue Staining.
4. Types of culture method Streak plate, Pour plate, Stab & Slant preparation.
5. Measurement of Growth rate of bacteria - Turbidometric method.
6. Isolation & Enumeration of Microorganism from Air, Water and Soil.
7. Hanging drop technique.
8. Catalase test, Oxidase test, Urease tests
9. Characterization of microorganisms -IMVIC tests.
10. Microscopic slide preparation –Fungi & Bacteria.
11. Antibiotic sensitivity Test - Kirby Bauer method.

Total: 30 Hours

Course Outcome:

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

CO-1: Understand the process and methods of sterilization and its techniques.

CO-2: To analyses different methods to isolate microorganisms from soil, water.

CO-3: To know the detailed process of Gram Staining, its procedure and negative staining.

CO-4: An introduction to obtain pure culture through streak plate method and serial dilution.

CO-5: To analyses the growth curve using growth curve analysis of bacteria.

Text and Reference Books:

1. Alfred Brown (2010), Bensons Microbiological Applications: Laboratory Manual in General Microbiology, Complete Version. Tata McGraw-Hill company, New Delhi.
2. John Harley (2010), Microbiology Lab Manual. Tata McGraw-Hill company, New Delhi.

3. Aneja. K. R (2007), Experiments in Microbiology, Plant pathology and Biotechnology, 4th Edition, New Age International Publishers, India.

4. James Cappuccino and Natalie Sherman (2004), Microbiology: A Laboratory Manual (7th Edition), Benjamin Cummings.

24PBBT22 PRACTICAL III - BIOCHEMISTRY

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVE:

To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.,).

LIST OF EXPERIMENTS:

1. Preparation and measurement of pH in standard buffers.
2. Validation of Beer's- Lambert Law by using $KMnO_4/K_2Cr_2O_7$.
3. Qualitative tests for carbohydrates.
4. Qualitative analysis of amino acids & proteins.
5. Qualitative analysis of lipids.
6. Quantitative estimation of protein using Lowry's Reagent.
7. Estimation of Glucose by Ortho toluidine method.
8. Quantitative analysis of urea in serum.
9. Quantitative estimation of serum cholesterol.
10. Chromatography: Separation of amino acid by Thin Layer Chromatography.

Total: 30 Hours

Course Outcome:

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

CO-1: Find the knowledge about pH and calculation.

CO-2: Understand the basic principles of biochemical estimations and assays.

CO-3: Examine knowledge in analysing various biomolecules both quantitatively and qualitatively.

CO-4: Evaluate the technique of chromatography and calculation.

CO-5: Elaborate on colorimetric and spectrophotometric techniques for analysis.

Text and Reference Books:

1. Jayaraman J (2011), Laboratory Manual in Biochemistry, 2nd Edition, New Age International Private Limited.
2. Sawhney S. K., Randhir Singh (2014), Eds, Introductory Practical Biochemistry, 5th or later edition, Narosa Publishing House, New Delhi.

3. Gupta R.C. and Bhargavan S (2018), Practical Biochemistry., CBS; 5th edition.
4. David T. Plummer (2006) "An Introduction to Practical Biochemistry", Tata McGraw Hill Publishing Company Ltd. New Delhi, 3rd Edition.
5. Boyer, R (2000), Experimental Biochemistry, Benjamin Cummings, Redwood City, California, USA.
6. Palanivelu, P (2001), Analytical Biochemistry and Separation Techniques. Kalaimani Printers.
7. Sadasivam, S. and A. Manickam (2002), Biochemical Methods. New Age International Pvt Ltd Publishers, New Delhi.

24DVAC21 COMMUNICATION SKILLS

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVE:

CO1: To develop effective verbal and non-verbal communication techniques for variouscontexts.

CO2: To enhance listening skills for better comprehension and engagement in conversations.

CO3: To improve written communication abilities, focusing on clarity, coherence, and style.

CO4: To build confidence in public speaking through practice and constructive feedback.

CO5: To cultivate interpersonal skills for successful collaboration and professional interactions.

Credit Hours

Credit Hour

UNIT I –INTRODUCTION TO COMMUNICATION SKILLS 6

- Fundamentals of Communications
- Elements of Communication, Types of Communication

UNIT II - PRACTICAL ENGLISH-I 6

- Importance of the language - Word Usage and Jargon
- Tenses and the effectiveness - Basics of grammar (Noun/Verb/Adverb/Conjunction)

UNIT III - EFFECTIVE COMMUNICATION MODULE-I 6

- LSRW (Listening, Speaking, Reading & Writing)
- Pronunciation - Vocabulary Building
- Intonations & its importance

UNIT IV - WORKPLACE COMMUNICATION 6

- Basics of telephone etiquette
- E-Mail writing
- Presentation Skills
- Interpersonal Skills
- Business English

UNIT V - QUANTITATIVE ABILITY 6

- Verbal Ability - Verbal Analogy
- Debating Skills - Public Speaking

Total: 30 Hours

Course Outcome:

At the end of this course, the students would have learnt to

CO1: Enhance participants' business communication skills

CO2: Enhance LSRW Skills (LSRW – Listening, Speaking, Reading & Writing)

CO3: Express opinions at free will in social/ personal gathering

CO4: Impact leadership qualities among participants

CO5: Engage in conversation with others to exchange ideas

References:

- Elizabeth Harren, 7 April, 2022, last updated: 16 November, 2023
- Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler (McGraw-Hill)
- Ethan Beute and Stephen Pacinelli (Greenleaf)

SEMESTER III

24LTAM31 பாடக் குறியீட்டு எண்:

L	T	P	O	C
2	0	0	1	2

பருவம்-3, தமிழ்மமாழிப்பாடம்-3, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2.

தாள்-3

சிற்றிலக்கியம். சிறுகதை, எழுதுதிறன், பேச்சுக்கலை.

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், பக்தி இலக்கியத்தை மாணவர்களுக்கு அறிமுகப்படுத்தி, அதன்வழி தமிழர்தம் பக்தி உணர்வையும் அதன் மேன்மையையும், கலைத்திறனையும் வெளிப்படுத்துதல், காப்பியம், புதினம் என்ற இலக்கிய வகைமைகளை அறிமுகப்படுத்துதல், மாணவர்களின் மொழித்திறனை மேம்படுத்தும் வகையில் மொழிபெயர்ப்பு, இலக்கணக் குறிப்பு என்பனவற்றை அறியச் செய்தல், மேற்கண்டவழி மாணவர்களைப் போட்டித்தேர்வுகளுக்குத் தயார் செய்தல் இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1: சிற்றிலக்கியம் 8 மணி நேரம்

1. நந்திக்கலம்பகம் - உரைவரம் பிகந்த உயர்புகழ்ப்
   வானுறுமதியை அடைந்தது உன்வதனம்
2. தமிழ்விடு தூது – 10 கண்ணிகள்
3. திருக்குற்றாலக் குறவஞ்சி – மலைவளம் கூறுதல் – முதல் 5 பாடல்கள்
4. கலிங்கத்துப் பரணி – பாலை பாடியது – முதல் 5 பாடல்கள்

அலகு 2: சிறுகதை 8 மணிநேரம்

1. அறிஞர் அண்ணா - செவ்வாழை
2. புதுமைப்பித்தன் - கடவுளும் கந்தசாமிப் பிள்ளையும்
3. கி.ராஜநாராயணன் - கதவு

அலகு 3 எழுதுதிறன் 7மணி நேரம்

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

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

அலகு 4: **பேச்சுக் கலை** 8 மணி நேரம்

பேச்சுத் திறன் – விளக்கம் – பேச்சுத்திறனின் அடிப்படைகள் – வகைகள் – மேடைப்பேச்சு – உடையாடல் - பயிற்சிகள்

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

15. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
16. **தவறின்றித் தமிழ் எழுதுவோம்,** மா. நன்னன், ஏகம் பதிப்பகம், 1999.
17. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
18. **தமிழ் இலக்கிய வரலாறு,** வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
19. **புதிய தமிழ் இலக்கிய வரலாறு,** நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
20. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
21. **பாடநூல் தேடலுக்கான இணையம் - https://archive.org/**

24LHIN31 **HINDI -III**

L	T	P	O	C
2	0	0	1	2

HINDI SYLLABUS (2024-25)

PAPER 3 - II YEAR

वर्ष II–सत्र III (आदि & मध्य कालीन पद्य, हिन्दी अनुवाद & विज्ञापन)

II Year-Sem III (Ancient & Medival Poetry, Hindi translation & Advertisement)

SUB CODE: 24LHIN31

Course Objectives :

- To enrich the knowledge of students about through Thirukkural
- To enable them to learn life values through ancient and medievial poems of Hindi Literature
- To develop translation and advertisements skills in Hindi

UNIT I : तिरुवल्लुवर कृत तिरुक्कुरल – 5, अमीर खुसरो कृत पहेलियाँ -5
'Thirukkural'- 5 Kural-by Thiruvalluvar & Amir Khusro-5 Paheliyan 6hrs.

UNIT II: कबीर के दोहे – 5
Kabir Ke Dohe,-5 6hrs.

UNIT III: तुलसीदास के पद – 2 & सूरदास के पद – 2
Tulsidas Ke Pad-2 & Surdas Ke Pad-2 6hrs.

UNIT IV: व्यावहारिक हिन्दी 1 – अनुवाद का परिचय (अर्थ, परिभाषा व प्रकार) & 5 - अभ्यास अनुछेद
Functional Hindi 1 - Introduction to Translation (Meaning, Definition &Types) & Exercise passages – 5 6hrs.

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UNIT V: व्यावहारिक हिन्दी 2 - विज्ञापन का परिचय (अर्थ, परिभाषा व प्रकार) & 4 – नमूना विज्ञापन
Advertisement –Introduction (Meaning, Definition & Types) & Model Advertisement - 4 6hrs.

Total: 30hrs

Course Outcome:
At the end of this course Students will
CO1 Know the valuable messages in social responsibilities
CO2 & CO3 Know the life values
CO4 Gain knowledge of translation in functional Hindi
CO5 Gain knowledge about advertisement skills in Hindi

Text/Reference book/Weblinks:
Thirukkural hindi translation by Venkata Krishnan
Ameer khusro ki paheliyan - https://www.hktbharat.com
Kabir ke Dohe - Kabir granthavali , Surhranthavali-http://kavitakosh.org
Tulsidas ke pad - http://kavitakosh.org

24LFRE31 **FRENCH - III**

L	T	P	O	C
2	0	0	1	2

Course Objectives :

The lessons are being chosen:

1) to express certainty and uncertainty
2) to express one's desire to do something
3) to express one's willingness and unwillingness to do something
4) to express one's joy and sorrow
5) to express one's fear, concern and astonishment
6) to express one's anger and regrets

Units:

1) Très drôle
le passe recent, passe compose et l'imparfait **6 hours**

2) Vous avez dit culture
l'interrogation et le subjonctif. **5 hours**

3) Envie d'ailleurs
les verbes aller/ retourner, venir/ revenir, ne...pas...ni, ne…ni…ni. **4 hours**

4) Voila l'été
le comparatif, superlatif et l'accord du participe passe avec avoir. **7 hours**

5) Terre inconnue
le plus-que parfait **3 hours**

6) Vivement dimanche
le pronom en et y, le subjonctif et les conjugaisons irrégulières. **5 hours**

Total no. of hours - 30

hours

Course Outcome:

1) The students would be able to express certainty and uncertainty.
2) The students would be able to express one's desire to do something.
3) The students would be able to express one's willingness and unwillingness to do something

4) The students would be able to express one's joy and sorrow.
5) The students would be able to express one's fear, concern and astonishment.
6) The students would be able to express one's anger and regrets.

Text / Reference Book:

1. Prescribed book: LATITUDES 1 (A2/B1) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau
2. Reference book: SAISON A2 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

VELS
KNOWLEDGE IS POWER

24LENG31 **ENGLISH III -GENERAL ENGLISH FOR COMPETITIVE EXAMINATIONS**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

- To enhance reading comprehension skills for understanding complex texts in competitive exams.
- To develop vocabulary and language proficiency to tackle verbal reasoning sections effectively.
- To improve grammar and writing skills for precise and coherent expression in written exams.
- To practice critical thinking and analytical reasoning abilities required for exam questions.
- To familiarise students with exam formats, strategies, and time management techniques for success in competitive exams.

.

UNIT I -Vocabulary **6**

Homophones, Homonyms, Note-taking, paraphrasing

UNIT II -Comprehension **6**

Reading comprehension, critical reading, cloze test

UNIT III- Grammar **6**

Idioms and phrases, Question tag, verbal phrases, Prepositions

UNIT IV -Grammar **6**

Voices, Indirect, Direct speech, simple, compound, complex

UNIT V- Academic Writing **6**

Precis writing, Report writing

TOTAL HOURS:30

COURSE OUTCOMES:

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

CO1	Imbibe the rules of language unconsciously and tune in to deduce language structure and usage.
CO2	Develop their abilities as critical readers and writers.
CO3	Decipher the mechanism of language and use it for success in competitive examinations and job-related speaking and writing tasks.
CO4	Construct grammatically flawless sentences in oral and written communication.
CO5	Express their thoughts and views in a concise manner in writing.

References:

- General English for competitive examinations by V. Rajagopalan (McGraw HillEducation) -2010.
- Technical Communication – Principles and Practices By Meenakshi Raman & Sangeeta K. Sharma, Oxford Univ. Press, 2016, New Delhi.

24CBBT31 CLINICAL DIAGNOSTIC TECHNIQUES

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

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

UNIT I: CLINICAL DIAGNOSIS 8

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

UNIT II: HAEMATOLOGY 9

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 grouping (ABO system &Rh system),

UNIT III: CLINICAL PATHOLOGY 9

Complete urine routine examination – physical, chemical and microbiological examination of urine, Culture and sensitivity test (Kirby-Bauer method) Complete routine examination of sputum and faeces. Semen analysis. Examination of CSF.

UNIT IV: CLINICAL SEROLOGY 10

Common serological tests - Pregnancy test, Widal test, Hepatitis B Surface Antigen detection test, Identification of malarial *parasites,* ELISA test. HLA, antinuclear antibody test, VDRL, Carbohydrate reactive protein test. Tests used to measure blood glucose level and diagnose DM: Fasting blood glucose test, 2-Hour Postprandial test. Oral Glucose Tolerance Test (OGTT). Hemoglobin A1c-Glycosylated Hemoglobin test.

UNIT V: MOLECULAR DIAGNOSTICS 9

Molecular Diagnostics of Infectious Diseases: Molecular diagnostics of infectious diseases such as, Leishmania, detection of large DNA viruses. Molecular diagnostics of non-infectious diseases such as cystic fibrosis, X-linked mental retardation disorder, Huntington disease, molecular markers for early detection of cancer.

Total: 45 Hours

COURSE OUTCOME:

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

CO-1: Knowledge of Clinical Specimen and their collections

CO-2: Understand the concept of hematology.

CO-3: Analyze clinical pathology

CO-4: Identifying the disease through the serological test

CO-5: Examine the different tests done carried out for clinical serology

CO-6: Determine the biotechnological approach for molecular diagnosis

CO-7: Understanding of analysis of blood glucose level and its diagnosis

TEXT BOOKS & REFERENCE BOOK

1. Bain, B. J. (2020). Blood Cells: A Practical Guide (5th ed.). Wiley-Blackwell.
2. Brunzel, N. A. (2018). Fundamentals of Urine and Body Fluid Analysis (4th ed.). Elsevier.
3. Turgeon, M. L. (2017). Linne & Ringsrud's Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications (8th ed.). Elsevier.
4. Pagana, K. D., Pagana, T. J., & Pagana, T. N. (2019). Mosby's Diagnostic and Laboratory Test Reference (14th ed.). Elsevier.
5. McPherson, R. A., & Pincus, M. R. (2017). Henry's Clinical Diagnosis and Management by Laboratory Methods (23rd ed.). Elsevier.
6. Pradeepkumar. (2011). NS.Manual of Practical Pathology, CBS Publishers and Distributors Pvt Ltd, Chennai.
7. Naigaonkar.A.V .and M.D.Burande (2004), A Manual of Medical Laboratory Technology, Nirali Prakashan. Pune.

5. David T (1978). Plummer, An Introduction to Practical Biochemistry – 3rd edition. Tata McGraw Hill Publishing Company Ltd New Delhi.

6. Lele Buckingham and Maribeth L (2007). Flaws, Molecular Diagnostics: Fundamentals, Methods & Clinical applications.

7. Lewin (2004). B Genes VIII, Oxford University Press.

8. Lewontin and W.M. Gelbart (1999), Modern Genetic Analysis, W.H. Freeman, New York.

9. Watson J.D (2004). Tania A baker, Stephen P. Bell, Alexander, Molecular Biology of the Gene.

10. David E. Bruns, Edward R. Ashwood, Carl A. Burtis (2007). Fundamentals of Molecular

Diagnostics. Saunders Group.

11. Watson, J.D. Tania A baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, (2004) Molecular Biology of the Gene. Pearson Education Pte. Ltd. (Singapore)
12. Rudin, N and Inman, K. (2002). An Introduction to Forensic DNA Analysis. CRC Press..

24CBBT32 **IMMUNOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE

The students will gain knowledge about the Antigen, Antibody immune response and reactions, cells involved in immunity, vaccines and tissue rejection.

UNIT I: INTRODUCTION TO IMMUNE SYSTEM 10

Introduction – Historical development in Immunology, Cells of the immune system – Primary and Secondary lymphoid organs – MALT, Development of B and T lymphocyte (Clonal selection theory). Types of immunity, Cytokines & Chemokines.

UNIT II: ANTIGEN AND ANTIBODY 9

Antigen: Characteristics and types. Antibody – Structure, Types, Properties and their Biological function. Polyclonal - monoclonal antibody production, Purification of antibodies and its biomedical applications.

UNIT III: ANTIGEN – ANTIBODY INTERACTIONS 9

Antigen – Antibody interactions: Avidity and affinity. Basic principles and applications of precipitation reactions (radial immunodiffusion, double immunodiffusion and immuno electrophoresis), agglutination reactions, RIA, ELISA and Western blotting.

UNIT IV: AUTO IMMUNE DISORDER & IMMUNO DEFICIENCY DISEASE 9

Structure and function of Class I and II MHC molecules. Complement Fixation. Autoantibodies – Autoimmune diseases - Rheumatoid Arthritis, Myasthenia Gravis, Systemic Lupus Erythematosus, Immuno deficiency disease.

UNIT V: VACCINE & HYPERSENSITIVITY REACTION 8

Active and Passive immunization – Vaccine and its types - recombinant vaccines, DNA Vaccine Hypersensitivity: An allergy, types of hypersensitivity. Immunology of hypersensitivity. Secondary immune response

Total: 45 Hours

COURSE OUTCOME

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

CO-1: Relates about immune system structure, functions and cytokines

CO-2: Identify structure of immunoglobulin, its types, purification and its applications.

CO-3: Understand about Antigen – Antibody interactions and its significance

CO-4: Make use of different techniques for identification on immunological reaction

CO-5: Analyze on MHC and its structures.

CO-6: Illustrate on types of autoimmune disorders and Immunodeficiency diseases.

CO-7: Comprehensive understanding on Vaccines and hypersensitivity reactions.

TEXT & REFERENCE BOOKS

1. Murphy, K., Weaver, C., & Berg, L. (2016). Janeway's Immunobiology (9th ed.). Garland Science.
2. Kindt, T. J., Goldsby, R. A., Osborne, B. A., & Kuby, J. (2018). Kuby Immunology (8th ed.). W.H. Freeman.
3. Parham, P. (2015). The Immune System (4th ed.). Garland Science.
4. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2017). Cellular and Molecular Immunology (9th ed.). Elsevier.
5. Judy Owen, Jenni Punt, Sharon Stanford (2013). Kuby Immunology. Macmillan Higher Education International publication.
6. Bazir A. (2012). Textbook of Immunology. Phi Learning Private Limited publication.
7. S.K. Mohanty (2013). Textbook of Immunology. K. Sai Leela. Jaypee Brothers Medical Publishers Pvt. Ltd.

Website Link

- www. immunologylink.com
- www.library.csusm.edu/courseguides/biology

24MBBT31 **BIOPHYSICS AND BIOSTATISTICS**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To impart knowledge on the structure of biomolecules, their orientation and acceptance of other molecules and to learn the knowhow of collection of data, and analysis using statistical methods.

UNIT I: BASIC CONCEPTS OF BIOPHYSICS 10

Bonding's in Biomolecules: covalent, ionic, peptide, coordinate bonds (strong interaction) – Hydrogen bonding and van der Waals forces. Structure and Properties of Water – Hydrophobic and Hydrophilic interaction. Law of thermodynamics.

UNIT II: STRUCTURAL ORGANISATION OF PROTEIN 8

Structural organization of protein – Forces stabilizing protein – Protein folding – Ramachandran plot – Structural Polymorphisms of DNA, tRNA and micro-RNA.

UNIT III: BIOPHYSICAL TECHNIQUE 7

Protein characterization and analysis - X-ray crystallography, Nuclear Magnetic resonance (NMR) spectra of proteins, X-ray diffraction, Cryo-Electron Microscopy, Electrophoresis Technique.

UNIT IV: STATISTICAL METHODS 10

Introduction – Scope and Limitations of Statistical methods - Concept of Sampling and Sampling Distribution - Diagrammatic and Graphical representation of data - Measures of Central tendency: Mean, Median, Mode– Measures of Dispersion- Range, Quartile Deviation, Standard Deviation and Coefficient of variation.

UNIT V: TESTS OF SIGNIFICANCE 10

Parameter and Statistics- Standard error – Tests of Significance for small samples: t-test for Single mean - Difference of means, F-test (variance –Ratio test), Chi-Square tests for goodness of fit and test for independence of attributes in contingency table.

Total: 45 Hours

COURSE OUTCOME:

CO1: Learning Basics about the Structure and Stability of Biomolecules.

CO2: Understand on the different forces stabilizing the biomolecules.

CO3: Learning the structure and stability of proteins and nucleic Acids.

CO4: Understanding about protein structure characterization and analysis

CO5: Gaining Practical knowledge on collection of data and data representation in different formats.

CO6: Illustrate on Mean, Median, Mode and its significance in Biostatistics

CO7: Knowledge related to Scientific analysis of data and representation of data in tabular format.

TEXT AND REFERENCE BOOKS:

1. Unwin, D. (2015). The Analysis of Biological Data. Roberts and Company Publishers.
2. P. Narayanan, (2008). Essentials of Biophysics ISBN-13**:** 978-8122420807,
3. William Bialek. (2012). Biophysics: Searching for Principles: ISBN-13: 978-0691138916: ISBN-10: 0691138915, Princeton University Press.
4. Nelson, P. (2015). Physical Models of Living Systems. W.H. Freeman.
5. Philip Nelson, Biological Physics: with New Art by David Goodsell ISBN-13: 978-0716798972 ISBN-10: 0716798972, 2013
6. Selvin, S. (2015). A Biostatistics Toolbox for Data Analysis. Cambridge University Press.
7. Gupta S.P., (2014). Sultan Chand & Sons, Statistical Methods: ISBN 978-93-5161-028-1,
8. Gupta S.C. and V.K. Kapoor, (2001). Fundamentals of Applied Statistics, Sultan Chand & Sons, 3rd Edition.,
9. Vital P.R., (2012). Business Statistics, Margham Publications, Second Edition, 2012.

24PBBT31 PRACTICAL IV: CLINICAL DIAGNOSTIC TECHNIQUES

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVE

The objective of this course will carry out the diagnostic Techniques in hematology, urology, serology and standardizing the laboratory protocols responsible for diagnoses.

LIST OF EXPERIMENTS

1. ABO Blood grouping, Rh typing
2. Estimation of hemoglobin by sahli's method
3. Counting of blood cell –RBC by Haemocytometer
4. Counting of blood cell –WBC by Haemocytometer
5. Counting of blood cell –Platelets by Haemocytometer
6. Identification of blood cells by study of peripheral blood smear.
7. Estimation of Bleeding time.
8. Estimation of clotting time.
9. Urine analysis: Colour reaction, Albumin, Sugar
10. Analysis of urine deposits (pus cells, Epithelia cells, RBC's and crystals) using microscope.

Total: 30 Hours

COURSE OUTCOME:

CO-1: Understand on ABO blood grouping and Rh typing

CO-2: Elaborate on Hb estimation and its significance.

CO-3: Understand about Bleeding time and clotting time and its analysis.

CO-4: Utilize the practical analysis of Hemoglobin, RBC, WBC, Platelets count, blood grouping from the blood sample and Blood analysis Total Count (TC), Differential Count (DC), ESR (Erythrocyte Sedimentation Rate.

CO-5: Test for biochemical analysis like Sugar (PP), Urea, Creatinine, Cholesterol, bilirubin, R.A factor from the blood and routine Urine analysis.

Text & Reference books:

1. McPherson, R. A., & Pincus, M. R. (2017). *Henry's Clinical Diagnosis and Management by Laboratory Methods* (23rd ed.). Elsevier.

2. Pagana, K. D., Pagana, T. J., & Pagana, T. N. (2019). *Mosby's Diagnostic and Laboratory Test Reference* (14th ed.). Elsevier.
3. James G. Cappuccino, Natalie Sherman, (2013) "Microbiology: A Laboratory Manual", Pearson Benjamin Cummings, 10th Edition
4. Betty.A.F,Daniel.F.S and A.S.Weisfeld, Bailey and Scott's (2002). Diagnostic Microbiology, Mosby(Elsevier),
5. Baron, E.J., (1997). Color Atlas of Diagnostic Microbiology, 1st Edition, Mosby
6. Naigaonkar.A.V. and M.D.Burande. (2004). A manual of Medical Laboratory Technology, NiraliPrakasan, Pune,India , 3rd, Edition.
7. Pradeep Kumar N.S. (2011). Manual of Practical Pathology,CBS Publishers and Distributors Pvt Ltd, New Delhi.

24PBBT32 **PRACTICAL V – IMMUNOLOGY**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To give practical training in immunological techniques

LIST OF EXPERIMENTS

1. Separation of serum and Plasma.
2. Blood grouping and Rh typing.
3. WBC counting
4. Differential blood count
5. WIDAL test
6. ASO test
7. Double Immunodiffusion
8. Single immunodiffusion
9. ELISA – DOT/ Plate
10. Handling of Laboratory animals - Demonstration

Total: 30 Hours

Course Outcome:

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

CO-1: Learn about Blood collection and maintenance

CO-2: Identify types of blood grouping and Rh type

CO-3: Knowledge about disease identification using Ag-Ab reaction

CO-4: Evaluate immunodiffusion techniques for Ag-Ab determination

CO-5: Elaborate about ELISA techniques

Text and Reference Books

1. Ashok Kumar Krishna Kumar & Jayanthi M (2024) Biochemical and Immunochemical Techniques – A Laboratory Manual, 1st Edition, Excellent Publisher
2. Nigam, A. (2007). Lab Manual of Biochemistry, Immunology and Biotechnology. Tata Mc Graw- Hill Education, New Delhi.
3. Myers, (1994). Immunology: A laboratory Manual, 2nd Edition, McGraw-Hill.
4. Catherine Sheehab (1997). Clinical immunology: principle and laboratory diagnosis.

INDIAN KNOWLEDGE SYSTEM

L	T	P	O	C
1	1	0	1	2

COURSE OBJECTIVES

- To Gain an understanding of Indian Knowledge System.
- To Develop an ability to apply the Indian Knowledge System to societal challenges faced today in areas such asholistic health, governance, public administration and sustainable living.
- To Promote the youths to do research in the various fields of Indian knowledge system.

UNIT 1: AN OVERVIEW OF INDIAN KNOWLEDGE SYSTEM 6

Introduction- Organization of Indian Knowledge System- The IKS corpus- A Classification framework- Historicity of Indian KnowledgeSystem -Some salient aspects of Indian Knowledge System

UNIT 2: PHILOSOPHICAL SYSTEM 6

Introduction to Philosophy- Development of Indian Philosophical system - Unique features of Indian Philosophical system- Introduction to Yoga.

UNIT 3 : GOVERNANCE AND PUBLIC ADMINISTRATION 6

Introduction - Understanding Governance from ancient to modern times- Relevance of Arthashastra- Glimpses of Nitishastra- Vidura Niti.

UNIT 4 : WISDOM THROUGH THE AGES 6

Gateways of ancestral wisdoms-Introduction to Purāṇa- The Purāṇic repository- Issues of interest in Purāṇas- Introduction to Itihāsas- Key messages in Itihāsa-Wisdom through Nīti-śāstra.

UNIT 5 MATHEMATICS 6

Introduction to Indian Mathematics- Unique aspects of Indian Mathematics- Indian Mathematicians and their Contributions.

Total: 30 hours

Text Books/Reference Book:

1. Mahadevan B., Bhat V R, Nagendra Pavana R.N., Indian Knowledge System Concepts andApplication, PHI Learning Pvt. Ltd., 2022.
2. Kapoor Kapil, and Singh Avadesh Kumar, Indian Knowledge System Vol.1, DK Print World,Ltd., 2005.

Elink:

1. https://onlinecourses.swayam2.ac.in/imb23_mg54/preview
2. https://digest.iimb.ac.in/2022/04/book-indian-knowledge-systems-co-authored-dr-b-mahadevan/
3. https://www.summarize.tech/www.youtube.com/watch?v=jcV0LIp570A

Course Outcomes

CO1	Classify the key concepts of Indian Knowledge System and discuss the multi-faceted nature of knowledgecontained in the Traditional Systems of India.	**K4**
CO2	Identify the rich heritage of governance in Indian Knowledge System.	**K3**
CO3	Recognize the relevance of Arthashastra in public administration.	**K3**
CO4	Identify the Wisdom through Ages through Ithihasas.	**K3**
CO5	Knowledge of Indian Mathematicians and their contributions.	**K3**

24IBBT31 **INTERNSHIP – I**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

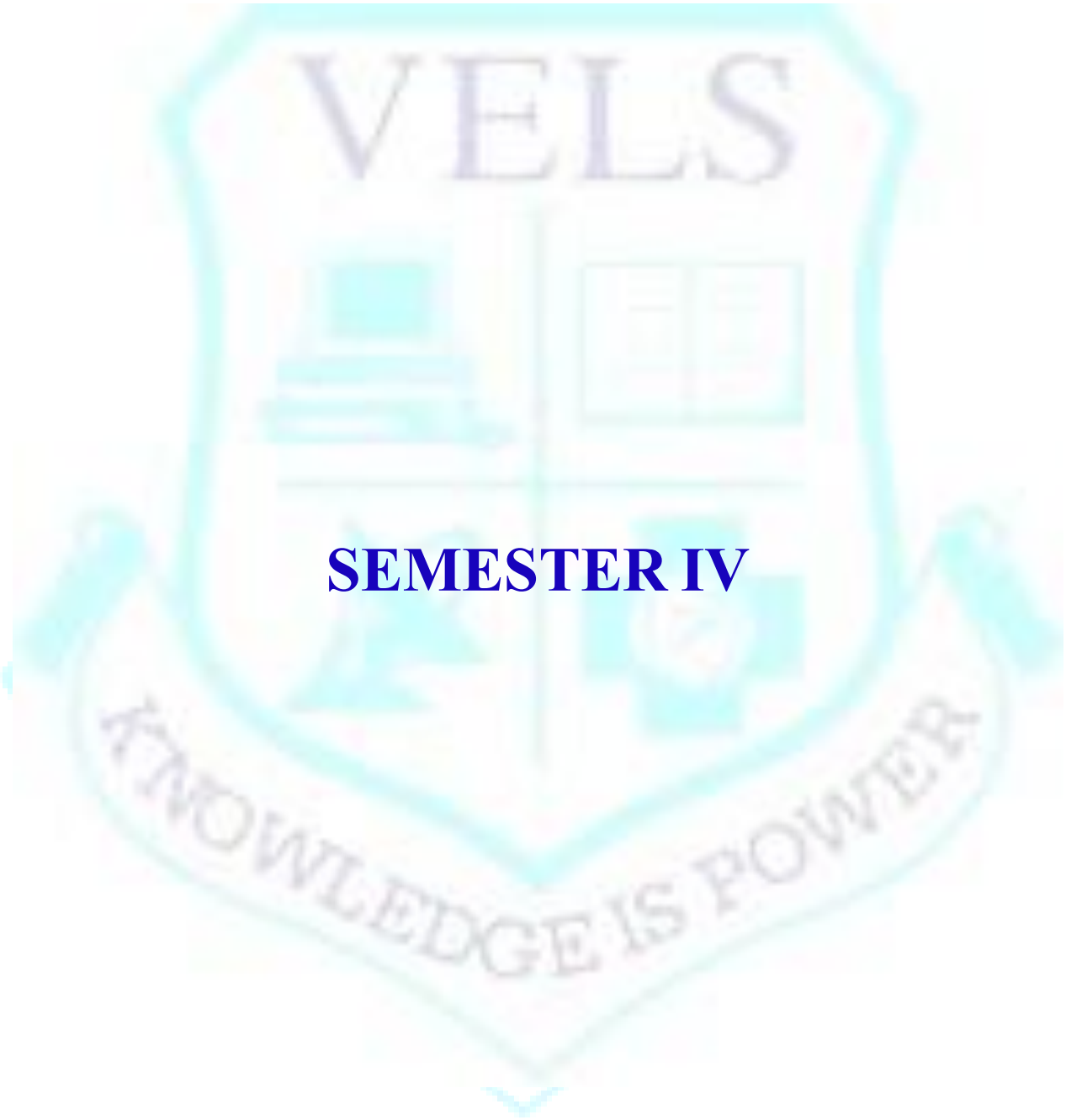
• For the benefit of the students, it has been mandatory to attend a minimum of one internship during semester vacation

• Student should go for Internship in any biotechnological industry or laboratories and learn their laboratory techniques by hands on training.

• After the Internship, student should submit detailed reports about the Internship in printed format.

• Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

• The report will be evaluated by duly appointed teaching faculty from head of department.



SEMESTER IV

24LTAM41

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2	0	0	1	2

பருவம்-4, தமிழ்மொழிப்பாடம்-4, பகுதி-1, தகுதிப்புள்ளி: 2, வாரப் பாட நேரம்: 2.

தாள்-4

மரபுக்கவிதை,புதுக்கவிதை,ஊடகத்தமிழ்,கணினித்தமிழ்

பாடத்திட்ட நோக்கம்:

தமிழர்தம் தொன்மைச் சிறப்பையும், பண்பாட்டுச் செழுமையையும் உலகிற்குப் பறைசாற்றும் சங்க இலக்கியங்களான எட்டுத்தொகை, பத்துப்பாட்டு நூல்களை அறியச் செய்தல், அதன்வழி பண்டைத் தமிழரின் விழுமியங்களை எடுத்துரைத்தல், இலக்கால இலக்கிய வகைமையான நாடக இலக்கியத்தை அறியச் செய்தல், ஊடகங்களில் தமிழின் பயன்பாடு, கணினியில் தமிழ்ப்பயன்பாடு என்பனவற்றை மாணவர்களுக்கு கற்றுக்கொடுத்தல், மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்தல் என்பன இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1: மரபுக்கவிதை 8 மணி நேரம்

1. பாரதியார் - பாரத தேசம் என்னும் தலைப்பில் ஆறு பாடல்கள். (பாடல் எண்கள் 1, 6, 7, 9, 12, 13)
2. பாரதிதாசன் – தமிழுக்கும் அமுதென்று பேர் என்னும் தலைப்பிலான கவிதை.
3. தேசிக விநாயகம் பிள்ளை - உடல் நலம் பேணல் என்னும் தலைப்பிலான கவிதை
4. முடியரசன் - காவியப் பாவை – "புண்படுமா" என்னும் கவிதை.

அலகு 2: புதுக்கவிதை 8 மணி நேரம்

1. நா. காமராசன் - *கறுப்பு மலர்கள்* தொகுப்பில் *காகிதப்பூக்கள்* என்னும் தலைப்பிலான கவிதை.
2. அப்துல் ரகுமான் - *ஆலாபனை* தொகுப்பில் *போட்டி* என்னும் தலைப்பிலான கவிதை
3. ஆண்டாள் பிரியதர்ஷினி – *முத்தங்கள் தீர்ந்துவிட்டன* தொகுப்பில் *'இங்கே வரும் போது'* என்னும் தலைப்பிலான கவிதை

அலகு 3 :**ஊடகத் தமிழ்**

இதழியல் - ஊடக வகைகள் - தலையங்கம்- நிகழ்ச்சியை செய்தியாக மாற்றுதல்- கருத்துப் பரிமாற்றம் நாடகம், திரைப்படம்,- வானொலி- தொலைக்காட்சி- மொழி நடையின் தன்மை -

அலகு 4 : **கணினித் தமிழ்**

கணினித் தமிழ்: கணினித் தமிழின் அடிப்படையும் பயன்பாடும் - கணிப்பொறியின் வரலாறும் வளர்ச்சியும், கணினியும் தமிழும், விசைப்பலகை (Keyboard) - எழுத்துருக்கள் (Fonts) - தமிழைத் தட்டச்சு செய்ய உதவும் மென்பொருள்கள், தமிழைத் தட்டச்சு செய்யும் முறைகள் - தமிழ்த் தட்டச்சுப் பயிற்சி - இணையமும் தமிழ்ப் பயன்பாடும் - தேடுபொறி (Search) - வலைப்பூ (Blog), மின்னூலகம் (Online e-Library), - மின்னகராதி(e-Dictionary), - மின் செய்தித்தாள் - e-Paper, - இணையவழித் தமிழ்க் கற்றலும்-கற்பித்தலும் - மின்வழிக் கற்றல் - e Learning.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

22. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
23. **தவறின்றித் தமிழ் எழுதுவோம்,** மா. நன்னன், ஏகம் பதிப்பகம், 1999.
24. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
25. **தமிழ் இலக்கிய வரலாறு,** வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
26. **புதிய தமிழ் இலக்கிய வரலாறு,** நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
27. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
28. **பாடநூல் தேடலுக்கான இணையம்** - https://archive.org/

24LHIN41

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HINDI SYLLABUS (2024-25)

PAPER 4 - II YEAR

II Year-Sem IV (Modern Poetry, Official Language & Stage Management)

वर्ष II – सत्र IV (नई कविता, राज भाषा & मंच संचालन)

SUB CODE: 24LHIN41

Course Objectives :

- To develop interest in various style of Modern and Contemporary Hindi Poetry
- To enable them to know about the Official Language Hindi
- To enable them to converse in Hindi

UNIT I : Bharatendu Harishchandra ki Mukhariyan-5. 6hrs.
भारतेन्दु हरिश्चंद्र की मुखरियाँ – 5

UNIT II : 'Bharatmata Gramavasi' (Kavita) by Sumitranand Pant 6hrs.
सुमित्रानंदन पंत कृत 'भारतमाता ग्रामवासी' (कविता)

UNIT III: 'Beej Vyatha' (Kavita) by Gyanendrapati 6hrs.
ज्ञानेन्द्रपती कृत 'बीज व्यथा' (कविता)

UNIT IV: Introduction to Official Language Hindi, framing questions from passages 6hrs.
राजभाषा हिन्दी का परिचय, अनुछेद से प्रश्न निर्माण

UNIT V : Introduction to Stage Management(Interview) 6hrs.
मंच संचालन (साक्षात्कार) का परिचय

Total: 30hrs

Course Outcome:

At the end of this course Students will
CO1 CO2 & CO3 Familiar with the different poetic expressions of Modern &

Contemporary Hindi Poetry

CO4 Know the importance of official language Hindi

CO5 Become conversant in Hindi

Text/Reference Book/Weblinks:

-http://kavitakosh.org

Bharatendu Harishchandra

https://www.amarujala.com/kavya/kavya-charcha/bhartendu-harishchandra-poems-naye-jamane-ki-mukariyan?page=5

Sumitranandan Pant- http://kavitakosh.org

https://www.hindiadda.com/beej-vyatha-gyanendrapati/

Hindi Rajbhasha: https://navodaya.gov.in

24LFRE41 **FRENCH IV**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES :

The lessons are being chosen:
1) to propose to do something and respond to a proposal
2) to respond to a request
3) to accuse, to blame
4) to complain, to protest
5) to express cause and consequence
6) to express opinion about facts

Units:

1)Entreprendre
Les pronoms démonstratifs, les pronoms interrogatifs. 6 hours

2) Vous avez gagne
Les pronoms en et y, les formation des adverbes en-ment 5 hours

3) Ne quittez pas
La mise en relief (c'est ..... qui, c'est …….que). 4 hours

4) Argent trop cher
l'opposition- toujours/ne…jamais. 4 hours

5) Le pétrole fou
la cause et la consequence. 5 hours

6) Parlez-moi d'amour
le conditionnel present, le gérondif. 6 hours

Total no. of hours: 30 hours

COURSE OUTCOMES

1. The students would be able to propose to do something and respond to a proposal
2. The students would be able to respond to a request
3. The students would be able to accuse, to blame
4. The students would be able to complain, to protest
5. The students would be able to express cause and consequence
6. The students would be able to express opinion about facts

Text / reference book:

1. Prescribed book: LATITUDES 1 (A2/B1) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau
2. Reference book: SAISON A2 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

24LENG41 **ENGLISH-IV PROFESSIONAL ENGLISH**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

- To improve professional vocabulary and language usage appropriate for various fields and industries.
- To practice critical thinking and problem-solving skills through case studies and discussions.
- To prepare students for job interviews, networking, and career advancement through professional English proficiency.

UNIT- I REPORT WRITING AND DATA INTERPRETATION 06

- Report Writing Business Report, Progress Report, Technical Report
- Instructions and Recommendations
- Interpretation of Graphs, Charts and Pictures

UNIT-II PROFESSIONAL WRITING I 06

- Agenda
- Minutes of the Meeting
- Review Writing
- Circular

UNIT III - PROFESSIONAL WRITING II 06

- Paragraph Writing
- Essay Writing
- Proposal Writing
- E-mail Writing

UNIT IV - SPEECH WRITING 06

- Tailoring the Speech for the Target Audience
- Writing for Professional Events - Welcome Address, Vote of Thanks
- Maintaining Clarity, Conciseness, and Precision

UNIT V - MEDIA WRITING 06

- Introduction to Media Writing - News, Feature, Editorial, and PR
- Writing for Social Media and Digital Platforms, Freelance Writing

Total Hours:30 hour

COURSE OUTCOMES:

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

CO1	demonstrate proficiency in language use.
CO2	master the nuances of Spoken and Written Communication skills in professional contexts.
CO3	develop confidence and clarity in Professional English usage.
CO4	organize their ideas coherently in writing for formal contexts.
CO5	exhibit their oral and written communication skills for professional contexts such aspresentations and meetings.

References Books:

- Professional English by Meenakshi Raman and Sangeetha Sharma -2018.
- General English for all competitive examinations by S.C.Gupta -2016.
- Ibbotson, Mark. Professional English in Use: Engineering: Technical English for Professionals. Cambridge University Press, 2009.
- Ruiz-Garrido, Miguel F., Juan C. Palmer-Silveira, and Inmaculada Fortanet-Gómez, eds. English for professional and academic purposes. Vol. 22. Amsterdam: Rodo

24EVS041 **ENVIRONMENTAL STUDIES**

L	T	P	O	C
3	0	0	2	3

Course Objective

- To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.

UNIT-I HUMAN COMMUNITIES AND THE ENVIRONMENT 9

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

UNIT II NATURAL RESOURCES AND SUSTAINABLE DEVELOPMENT 9

Renewable and non-renewable resources - Natural resources and associated problems. a) Forest resources b) Water resources c) Mineral resources d) Food resources e) Energy resources: f) Land resources; Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

UNIT-III ECOSYSTEM AND BIODIVERSITY 9

Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics-forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches;

UNIT-IV ENVIRONMENTAL POLLUTION AND HEALTH 9

Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution; Causes, effects and control measures of a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards. Solid waste Management. Causes, effects and control

measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

UNIT-V ENVIRONMENTAL TREATIES AND LEGISLATION 9

Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer;

Environmental laws:

Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act - Issues involved in enforcement of environmental legislation. Public awareness.

Total: 45 hours

Text Books

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. William P. Cunningham and Mary Ann Cunningham, Environmental Science: A Global Concern 14th Edition, 2021.
3. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
4. Climate change: Science and politics (2021), Centre science and Environment, New Delhi,

Reference Books

1. Daniel B. Botkin and Edward A. Keller, **Environmental Science: Earth as a Living Planet,** 9th Edition, New Age International 2022.
2. Jadhav H and Bhosale VM, Environmental Protection and Laws. Himalaya Publishing House, Delhi 284pgs 2023.

	Course Outcomes	K Level
CO1:	Gain insights into the international efforts to safeguard the Earth's environment and resources.	**K2**
CO2:	Understand the concept of natural resources; identify types of natural resources, their distribution and use with special reference to India.	**K4**
CO3:	Understand the concepts of ecosystems, biodiversity and conservation.	**K1**
CO4:	Sensitize themselves to adverse health impacts of pollution.	**K3**
CO5:	Understand the sectoral effects on the local, regional, and global environmental issues	**K2**

Web link and we source

https://easyengineering.net/ge6351-environmental-science-and/

https://learnengineering.in/ge8291-environmental-science-and-engineering

https://cpcb.nic.in/ standards/

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24CBBT41 PLANT BIOTECHNOLOGY

COURSE OBJECTIVE:

Upon taking this course, the students will gain vast knowledge on applications of plant tissue culture and related genetic engineering techniques.

UNIT I: GENOME ORGANIZATION 10

History of Plant Biotechnology, Conservation of Plant using Biotechnology, Plant genome organization: structural feature of a representative plant gene, gene families in plants. Organization of chloroplast genome and mitochondrial genome, Regulation and control of gene expression.

UNIT II: INTRODUCTION TO PLANT TISSUE CULTURE 08

History and Scope of Plant Tissue Culture, Totipotency, Media Preparation – Types of Media, Plant Hormones- Auxins, Cytokinin's, Gibberellins, Abscisic acid and Ethylene. Phytochrome morphogenesis, Seed storage protein.

UNIT III: PLANT TISSUE CULTURE 07

Types of Culture Techniques – micropropagation, callus induction, organogenesis (direct and indirect), Suspension culture, Production of haploid and triploid plant, Protoplast isolation and its application, Somatic embryogenesis, Production of Artificial Seed.

UNIT IV: GENETIC TRANSFORMATION 10

Agrobacterium – crown gall tumours, Ti plasmid vectors – molecular mechanism of T-DNA transfer, use of transgenic plants, Types of cloning vectors - Symbiotic nitrogen fixation in legumes by Rhizobia – biochemistry and molecular biology.

UNIT V: GENETIC ENGINEERING 10

Genetic Engineering in plants – Selectable markers, reporter genes and promoters used in plant vectors**.** Construction of genome libraries and cDNA libraries. Recombinants selection and screening – analysis of recombinant DNA. Transgenic plants and their applications, molecular pharming.

Total: 45 Hours

COURSE OUTCOME:

CO-1: Outline the history of plant biotechnology and explain regulation and control of gene expression

CO-2: Understand the Organization of Subcellular genome.

CO-3: Illustrates about various culture medium preparations and role of phytohormones in plants.

CO-4: Learns in-depth the basic techniques of plant tissue culture and its application, haploid, triploid plant production, and its application.

CO-5: Get better at molecular techniques for growing plant cells using Ti plasmid vectors in agrobacterium and transgenic plants.

CO-6: Elaborate on the genetic engineering and construction of DNA libraries.

CO-7: Illustrate on development of transgenic plants and its application

TEXT & REFERENCE BOOKS:

1. Razdan, M.K. (2019). Plant tissue culture, (3rd edition). New Delhi. Oxford & IBH Publishing company, ISBN-13: 978-8120417939.
2. Das, H.K. (2018), Text Book of Biotechnology, (5th edition). New Jersey, Wiley Dreamtech, India Pvt. Ltd.
3. Chawla, H.S. (2010), Introduction to Plant Biotechnology. New Delhi. Oxford & IBH Publishing company, ISBN 13: 9781578081301 3. Satyanarayana, U. (2017), Biotechnology, (2nd edition). Kolkata. Books & Allied (P) Ltd, ISBN-13: 978-8187134909.
4. Slater, (2008), Plant Biotechnology- The Genetic Manipulation of Plants, (2nd edition), New Jersey. Humana Press.

24CBBT42 **ANIMAL BIOTECHNOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

There is a wide scope for animal biotechnologists, as they can be absorbed by the biotechnology industry, research organizations, food processing units, the defence sector and pharmaceutical industry.

UNIT I: INTRODUCTION TO ANIMAL TISSUE CULTURE 9

Historical aspects - Basics concepts of - Animal cell culture – Primary cell culture, establishment of culture, and maintenance of culture. Media – Natural media and Synthetic media.

UNIT II: ESTABLISHMENT OF ANIMAL CELL CULTURE 9

Basic of mammalian cell culture, Techniques for disaggregation of animal tissue – Mechanical, Enzymatic and EDTA. Evolution of cell line, Monolayer culture, Suspension culture, Immobilized culture, Organ culture – plasma clot, raft method, agar gel, grid method, embryo culture, and maintenance of cell culture.

UNIT III: EMBRYO TECHNOLOGY 9

Artificial insemination, Super ovulation, In vitro fertilization and embryo transfer, applications and limitation, Transgenic animals (avian, rodent & ruminants), Transgenic methods, Embryonic Stem cell transfer, Targeted Gene Transfer, Detection of transgenic animals, Production of useful proteins in transgenic animals, Sericulture basics and production of useful proteins through sericulture

UNIT IV: MOLECULAR TECHNIQUES IN ANIMAL CELL CULTURE 9

Molecular Markers – RFLP, RAPD, VNTR, AFLP. Role of Animal Models in Experimentation. Somatic and Reproductive cloning – Somatic cell nuclear transfer, story of dolly, Therapeutic cloning and its significance.

UNIT V: APPLICATION 9

Animal diseases (cattle) -Mad cow, Anthrax, Foot and Mouth, Lumpy skin, Bluetongue; (Poultry) - Newcastle; Bird flu, Avian Influenza, Marek's disease – Vaccines; Bioethics and biosafety in animal handling.

Total: 45 Hours

COURSE OUTCOMES

CO-1: Ideas about Animal tissue culture techniques and design

CO-2: Illustrate on the different types of Mammalian cell culture

CO-3: Understand Organ culture and embryo culture techniques.

CO-4: Demonstrate competency in various gene transfer techniques in animals.

CO-5: Explain on different types of molecular markers.

CO-6: Diagnose zoonotic diseases using modern techniques

CO-7: Differentiate various vaccine-producing methodologies

TEXT & REFERENCE BOOKS

1. Singh, B. (2016). Textbook of Animal Biotechnology. The Energy and Resources Institute (TERI) Press.
2. Verma, A. S., & Singh, A. (Eds.). (2018). Animal Biotechnology: Models in Discovery and Translation. Academic Press.
3. Choudhary, R. K., & Choudhary, S. (2022). Stem Cells in Veterinary Science. Springer.
4. Kreuzer, H. and Massey, A. (2001). Recombinant DNA and Biotechnology: A guide for teachers, 2nd edition. ASM Press Washington.
5. Puhler, A.V.C.H. (1993). Genetic engineering of Animals. VCH Publishers, Weinbeim, FRG.
6. Glick, B.R. and Pasternark. (2002). Molecular Biotechnology: Principle and applications of recombinant DNA.
7. Ramasamy. P. (2002). Trends in Biotechnology, University of Madras of Publications, Pearl Press

Useful Links

1.https://www.sanfoundry.com › best-reference-books-animal-cell-tissue-im...

2.https://micro.magnet.fsu.edu › cells › animal cell

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24PBBT41 PRACTICAL V – PLANT BIOTECHNOLOGY

COURSE OBJECTIVES:

By taking this course, the students will be able to develop their skills in plant tissue culture techniques

List of Experiments

1. Media components and preparation
2. In vitro germination of seeds
3. Callus development
4. Micropropagation of plant
5. Anther culture – haploid production
6. Isolation of protoplast
7. Culturing of protoplast
8. Synthetic Seed Production
9. Isolation of genomic DNA from plant sample
10. Agrobacterium mediated gene transfer (Demo)

Total: 30 Hours

COURSE OUTCOME:

CO-1: Understand the composition, role, and preparation of media used in plant tissue culture.

CO-2: Demonstrate the techniques involved in in vitro germination, callus induction, and micropropagation.

CO-3: Compare methods of haploid production, protoplast isolation, and protoplast culture.

CO-4: Explain the applications of synthetic seed production and its significance in plant propagation.

CO-5: Understand the principles of plant genomic DNA isolation and the concept of gene transfer using Agrobacterium**.**

TEXT & REFERENCE BOOK

1. Tahakik, R. (2021). Practical Manual - Plant Tissue Culture. Department of Plant Biotechnology

2. Chau, A. (2019). Exploring the World of Plants: General Botany Laboratory Manual. Kendall Hunt Publishing.
3. Rani, A. (2015). Practical Plant Biotechnology and Genetics. New India Publishing Agency.
4. Ignacimuthu, S., (2004). Plant Biotechnology. Oxford and IBH Publishing House, New Delhi.
5. Maliga, P., (1995). Methods in Plant Molecular Biology - A Laboratory Course. Oxford Press, New York. 1995.
6. Sambrook, J, Fritsch, E.F and Maniatis T, (2002). Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York.

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24PBBT42 PRACTICAL VI – ANIMAL BIOTECHNOLOGY

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To develop their skills in the Animal tissue culture techniques

List of Experiments:

1. Cleaning and sterilization of glassware.
2. Designing of animal cell culture laboratory.
3. Preparation of Tissue culture medium and membrane filtration
4. Preparation of Single cell Suspension
5. Cell counting and cell viability
6. Role of serum in cell culture
7. Trypsinization of monolayer and sub culturing
8. Cryopreservation and thawing of cell line.
9. MTT Assay (Demo)

Total: 30 Hours

COURSE OUTCOME:

CO-1: Learn about basic concept of animal tissue culture techniques

CO-2: Understand about medium used for animal tissue culture

CO-3: Compare various methods cell culture technique

CO-4: Importance of cryopreservation methods to maintain cell culture

CO-5: Understand the concept of cytotoxicity.

TEXT & REFERENCE BOOKS

1. Gahlawat, S. K., & Duhan, J. S. (2018). Advances in Animal Biotechnology and its Applications. Springer.
2. Singh, B. (2015). Textbook of Animal Biotechnology. The Energy and Resources Institute (TERI).
3. Verma, A. S., & Singh, A. (2013). Animal Biotechnology: Models in Discovery and Translation. Academic Press.

4. Kumar, V., & Gill, K. D. (2013). Basic Concepts in Clinical Biochemistry: A Practical Guide. Springer.
5. Pandey, B. N. (2012). Advances in Animal Biotechnology and its Applications. McGraw-Hill.
6. Freshney, R.I. (2000). Animal Cell Culture: A Practical Approach. John Wiley & Sons, New York.
7. Masters, J.R.W. (2000). Animal Cell Culture: Practical Approaches. Oxford University Press, London.

24DVAC41 **YOGA EDUCATION**

L	T	P	O	C
0	0	2	1	1

Course Objective

The students will be able to:
- Understand the philosophy, aims, and health benefits of Yoga.
- Gain practical knowledge of yogic postures, breathing techniques, and relaxation practices.
- Apply yogic methods for stress reduction, emotional balance, and focus enhancement.
- Incorporate Yoga as a tool for lifestyle improvement, well-being, and inner awareness.

UNIT-I INTRODUCTION TO YOGA 5

Definition and meaning of Yoga – Classical and modern perspectives. -Philosophy and objectives of Yoga-Benefits of Yoga for physical, mental, and emotional health -Relevance of Yoga in daily life, especially for students and professionals - Guidelines for safe and mindful Yoga practice

UNIT II YOGA PRACTICES – ASANAS AND BREATHING 5

Loosening and warm-up exercises Neck, shoulder, spine, and joint movements - Standing AsanasTadasana, Trikonasana, Vrikshasana - Sitting AsanasVajrasana, Ardha Matsyendrasana, Bhadrasana - Prone and Supine AsanasBhujangasana, Shalabhasana, Pavanamuktasana - Breathing Practices (Pranayama)Anulom Vilom, Bhramari, Sheetali, Sheetkari - Relaxation TechniquesDeep Relaxation Technique (DRT)

UNIT-III YOGA FOR MENTAL WELL-BEING & LIFESTYLE MANAGEMENT 5

Ecosystems and ecosystem services: Major ecosystem types in India and their basic Role of Yoga in managing stress, anxiety, and fatigue - Importance of meditation and breath regulation - Basics of meditation: breath-based and mindfulness - Yogic lifestyle guidelines – diet, discipline, sleep, and conduct - Integrating Yoga into student routine for balance and productivity

Total: 15 hours

Text Books & Reference Books

1. Ministry of AYUSH. (2023). Common Yoga Protocol. Government of India
2. Swami Satyananda Saraswati. Asana, Pranayama, Mudra, Bandha. Bihar School of Yoga
3. Dr. R. Nagarathna & Dr. H. R. Nagendra. Yoga for Students. SVYASA
4. NCERT. (2020). Yoga – A Healthy Way of Living (Upper Primary and Secondary)

Course Outcomes (CO): At the end of this course, learners will be able to:

Course Outcomes	
CO1:	Explain the meaning and relevance of Yoga for overall well-being.
CO2:	Demonstrate basic asanas and breathing techniques with proper alignment.
CO3:	Practice guided relaxation and introductory meditation.

24DVAC51 **NATIONAL SERVICE SCHEME**

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Course Objectives:

The students will be able to understand the concept of youth and the importance of youth population in Nation Building. The course also enable the students to appraise the nature and growth of national service scheme in India. The course enable the students to perceive the aims, objectives, logo, emblem and organizational structure of NSS.

UNIT-I INTRODUCTION **05**

Introduction to National Service Scheme. Philosophy of NSS. Basic concepts of NSS-Motto, Symbol, Badge, NSS Day. NSS programs and activities; NSS Components-Programme Officer, Volunteer, Community. Classification of NSS Programme.

UNIT-II ACTIVITIES OF NSS **05**

Regular activities of NSS – Adoption of villages, slums etc., Coordination with Voluntary Organizations, National Service Volunteer Scheme (NSVS), Day Camps, Special Camping Program-objectives, contributions and activities.

UNIT-III ADMINISTRATION, PLANNING & IMPLEMENTATION OF NSS PROGRAMS **05**

Administrative structure of NSS at National, State and University levels. NSS advisory committees. Planning and Implementation of NSS Programs-Off campus activities- Rally, Swatchatha Programme, Visit to heritage sites, conserving ancient monuments, Women empowerment program, Blood donation, Water conservation program etc.

Total Hours: 15

Course Outcome

At the end of the course, learners will be able to:

CO1: To explain the philosophy and basic concepts of NSS.

CO2: To appraise the activities of NSS.

CO3: To discuss the concepts of Special Camping Program.

Textbooks

1. National Service Scheme Manual (Revised), (2006), Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. Afsal Mohammad B, (2020), An introduction to volunteerism in India.

SEMESTER V

24CBBT51 BIOFERMENTATION AND DOWNSTREAM PROCESSING

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

The students would be equipped with Industrial knowledge of fermentation and downstream processes. It also helps in understanding the Industrial application.

UNIT I: INTRODUCTION TO FERMENTATION TECHNOLOGY 9

Range of Fermentation Process; Microbial Growth Kinetics – Batch, Continuous and Fed-batch; Isolation, screening and maintenance of industrially useful microorganisms – Strain improvement.

UNIT II: MEDIA FOR INDUSTRIAL FERMENTATIONS 9

Media ingredients, media formulation, oxygen requirements, antifoams, medium optimization; Media Sterilization – Batch sterilization, Continuous sterilization process and, Filter sterilization of media and air.

UNIT III: FERMENTATION PROCESS 9

Submerged and solid state; Design and parts of Fermenter – agitation, aeration, pH, temperature, dissolved oxygen – control and monitoring; Types of Bioreactors – Packed bed Bioreactor, Fluidized bed Bioreactor, Trickle bed reactor, Bubble column reactor

UNIT IV: DOWNSTREAM PROCESSING 9

Solid and liquid separation, cell disruption, separation, liquid – liquid extraction, precipitation, chromatography and drying. Immobilization of Enzymes.

UNIT V: APPLICATIONS 9

Industrial scale production of yeast biomass. Production – Alcohol, Penicillin, Citric acid, Vitamin B12, Riboflavin, alpha amylase and protease.

Total Hour: 45 Hours

Course Outcome:

CO-1: Understand on the introduction to fermentation and its types.

CO-2: Illustrate on the components required in fermentation process.

CO-3: Explain on different types of sterilization used in the fermentation process.

CO-4: Demonstrate on Design, Operation and types of Bioreactors

CO-5: Illustrate on stages of downstream processing.

CO-6: Understand on the immobilization of enzyme and its applications.

CO-7: Illustrate on Industrial applications of Bioprocess technology and product produced.

Text and Reference Books:

1. Mansi, E. M. T. El, Bryce, C. F. A., Demain, A. L., & Allman, A. R. (2019). Fermentation Microbiology and Biotechnology (4th Edition). CRC Press.
2. Stanbury P., Whitaker *A*. (2017). Stephen H. Principles of Fermentation Technology 3rd Edition Butterworth-Heinemann.
3. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2016). Principles of Fermentation Technology (3rd Edition). Elsevier.
4. Saha, B. C. (2016). Fermentation Biotechnology. CRC Press.
5. Prescott SC and Dunn CG. (2011). Industrial Microbiology Jodhpur Agrobios.2011.
6. Sivasankar, B. (2005). "Bio separations: Principles and Techniques". PHI, 2005.
7. Stanbury, P.F., A. Whitaker & S.J. Hall. (1997). Principles of fermentation technology Oxford Press.
8. Brian, M. and L. (2008). Harvey, Practical Fermentation Technology, John Wiley & Sons Inc.,

24CBBT52 **GENETIC ENGINEERING**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To understand vector biology, principles in cloning, and cloning strategies for prokaryotes and eukaryotes.

UNIT I INTRODUCTION TO GENETIC ENGINEERING 12

Gene cloning – isolation and purification of DNA and Plasmids. DNA manipulating enzymes – Nuclease - types, Restriction enzymes, Ligase, Polymerase, DNA Modifying enzymes, other enzymes, linkers, adaptors and homopolymer tailing.

UNIT II CLONING VECTORS 12

Cloning vectors- salient features, types of plasmid vectors - Natural, Artificial - pBR322 and its construction, PUC- phage vectors (Lambda and M13 phages) - cosmids, phagemids, viral vector – baculoviral, retroviral, CaMV, TMV, BAC, YAC, Shuttle vector.

UNIT III TECHNIQUES IN IDENTIFICATION 12

Electrophoresis of DNA, RNA and Protein - Nucleic acid staining - Molecular probes, Nucleic acid Labelling methods - Southern, Northern and Western Blotting. Autoradiography.

UNIT IV GENE TRANSFER TECHNIQUE 12

Methods of gene transfer: Chemical Transfection, Physical Transfection and Virus Mediated Transduction, PCR, Types of PCR- RFLP, RAPD – DNA Sequencing- DNA Libraries (Genomic, cDNA Libraries).

UNIT V APPLICATIONS OF GENETIC ENGINEERING 12

Gene therapy and its types - Protein engineering - Expression of recombinant proteins in *E. coli* – insulin. Recombinant vaccine, Antisense technology - DNA fingerprinting- Gene knockouts- GMO.

Total Hour: 60 Hours

Course Outcome:

CO-1: Learn about the fundamental principles of cloning vectors

CO-2: Understand on Enzymes involved in genetic engineering

CO-3: Understand the various types of vectors used for cloning

CO-4: Identification of Nucleic acids using various molecular techniques

CO-5: Analysis of Gene transfer technologies and amplification of Nucleic acids

CO-6: Illustrate on DNA Libraries and its applications.

CO-7: Applying genetic engineering techniques in protein synthesis.

Text and Reference Books:

1. Brown, T. A. (2019). Gene Cloning and DNA Analysis: An Introduction (8th Edition). Wiley-Blackwell.
2. Glick, B. R., & Pasternak, J. J. (2017). Molecular Biotechnology: Principles and Applications of Recombinant DNA (5th Edition). ASM Press.
3. Frederick M. Ausubel, et al. (2017). Current Protocols in Molecular Biology. Wiley-Interscience
4. Sambrook, J., & Russell, D. W. (2016). Molecular Cloning: A Laboratory Manual (4th Edition). Cold Spring Harbor Laboratory Press.
5. Singh B.D., (2005). Molecular biology and Genetic Engineering, Kalyani publishers.
6. Primrose, S.B. (2001). Molecular Biotechnology. Panima Publishing House, New Delhi, India.
7. Brown T.A., (2010). Gene cloning and DNA analysis, 6th edition, Wiley Blackwell science
8. Watson, (2004). Molecular Biology of the gene, 5th edition Person education, Singapore. 2004
9. Kreuzer-Massey, (2001). Recombinant DNA and Biotechnology, ASM Press.
10. Walker J.M. and R. Rapley, (2006). Molecular Biology and Biotechnology, 4th edition.
11. Glick, B.R. and J.J. Pasternak, (2002). Molecular Biotechnology. Panima Publishing House, New Delhi, India.

24PBBT51 PRACTICAL VII – BIOFERMENTATION

L	T	P	O	C
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COURSE OBJECTIVE

To obtain hands-on experience on fermentation and the downstream processing stages like cell disruption, isolation, purification, and formulation.

List of Experiments

1. Production of ethanol from grape juice using yeast fermentation process
2. Growth Curve Method
3. Citric acid Production
4. Solid state Fermentation
5. Preservation of culture for fermentation process
6. Isolation of casein from milk (Isoelectric precipitation)
7. Separation of plant pigments by Thin Layer Chromatography
8. Protein purification by Ammonium sulfate precipitation
9. Isolation and Crystallization of Benzoic acid from soft drinks.

Total Hour: 30 Hours

Course Outcomes:

CO-1: Understand the process of alcohol production

CO-2: Estimate the concentration of substances

CO-3: Analyze different techniques in fermentation and downstream processing.

CO-4: Evaluate growth kinetics and optimize the concentration of nutrients in a medium

CO-5: Validate knowledge of the different stages of downstream processing.

Text and Reference Books:

1. Frazier & Westhoff (2023). Fermentation: A Practical Approach.(2023) Edited by x
2. Surya Prakash Dwivedi (2023). Fundamentals of Fermentation Technology. Ennoble IP Books and Publications Noida, India.
3. Mansi, E. M. T. El, Bryce, C. F. A., Demain, A. L., & Allman, A. R. (2019). Fermentation Microbiology and Biotechnology (4th Edition). CRC Press.

4. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2016). Principles of Fermentation Technology (3rd Edition). Elsevier.

5. Prescott, S.C. and Dunn, C. G., (1983). Industrial Microbiology, Reed G. AVI tech Books.

24PBBT52 **PRACTICAL VIII - GENETIC ENGINEERING**

L	T	P	O	C
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COURSE OBJECTIVE:

To provide the basic practical skills of genetic engineering techniques

List of Experiments:

1. Isolation of genomic DNA from Bacteria
2. Isolation of genomic DNA from Plant
3. Isolation of genomic DNA from Animal
4. Isolation of plasmid DNA
5. Agarose gel electrophoresis
6. Quantification of nucleic acids
7. Estimation of DNA
8. Restriction digestion
9. Ligation
10. PCR - DEMO

Total Hour: 30 Hours

COURSE OUTCOME:

CO-1: Learn about culturing of bacteria for DNA Isolation

CO-2: Understanding the knowledge about different methods of DNA isolation

CO-3: Obtain practical knowledge in analysing various enzymes used for cut the DNA

CO-4: Identify which enzyme used for joining two sequences in genetic engineering.

CO-5: Create DNA multiple copies using PCR techniques.

Text and Reference Books:

1. Brown, T. A. (2019). Gene Cloning and DNA Analysis: An Introduction (8th Edition). Wiley-Blackwell.

2. Glick, B. R., & Pasternak, J. J. (2017). Molecular Biotechnology: Principles and Applications of Recombinant DNA (5th Edition). ASM Press.
3. Frederick M. Ausubel, et al. (2017). Current Protocols in Molecular Biology. Wiley-Interscience.
4. Sengar. R.S, Pooran Chand, Shalini Gupta, Manoj K.Yadav and Purushotam, (2012). Laboratory Manual on Molecular Biology and Genetic Engineering. Department of Agriculture Biotechnology, Modipuram..
5. Sambrook, J, E.F. Fritsch and T. Maniatis, (2000). Molecular Cloning, A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York.
6. Glover, D.M. and B.D. Hames, (2000). DNA Cloning a Practical Approach. IRL Press, Oxford. 2000.
7. James, J.G. and V.B. Rao, (2001). Recombinant DNA Principles and Methodologies. Marcel Dekker Publications, New York. 2001.

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24SBBT51 ENTERPRENEURIAL DEVELOPMENT

COURSE OBJECTIVE:

To enrich the students towards the knowledge of entrepreneurial skills and to make the students understand the approaches to attain the goals of the business.

UNIT 1: INTRODUCTION TO ENTREPRENEURSHIP 06

Introduction, Concept of Entrepreneur, Entrepreneurship and Enterprise, Definition of Entrepreneurship, Objectives of Entrepreneurship Development, Phases of Entrepreneurship Development, Role of Entrepreneurship, The Entrepreneurial Mindset, Characteristics of Entrepreneurship, Traits of Entrepreneurship, Introduction to Entrepreneurship Skills

UNIT 2: ENTREPRENEURSHIP DEVELOPMENT SKILLS 06

Meaning of Entrepreneurship skill, Types of Entrepreneurship Skills: Business management skills, Teamwork and leadership skills, Communication and listening, Customer service skills, Financial skills, Analytical and problem-solving skills, Critical thinking skills, Strategic thinking and planning skills, Technical skills, Time management and organizational skills, Branding, marketing and networking skills, How to improve entrepreneurial skills, Entrepreneurial skills in the workplace.

UNIT 3: TYPES OF ENTREPRENEURS 06

Classification and Types of Entrepreneurs; Women Entrepreneurs; Social Entrepreneurship; Corporate Entrepreneurs, Family Business: Concept, structure, and kinds of family firms; Culture and evolution of family firm; Managing Business.

UNIT 4: ENTREPRENEUR PROJECT DEVELOPMENT & BUSINESS PLAN 06

Generation of Ideas-Innovation, Invention, Creativity, Business Idea and change. Idea generation. Kinds of Business Analysis-Concept of Environmental scanning and SWOT analysis. Business Planning Process-The business plan as an Entrepreneurial tool, scope and value of Business plan. Fundamental Elements of Business-Plan, Objectives, Market and Feasibility Analysis, Marketing, Finance, Organisation & Management and Ownership.

UNIT 5: MOBILIZING RESOURCES 06

Resource Mobilization for entrepreneurship: Resources mobilization, types of resources, Process of resource mobilization, Arrangement of funds; writing a Funding Proposal, Traditional sources of financing, Venture capital, Angel investors, Business Incubators

Total: 30 Hrs

Course Outcome:

At the end of the course, a student will be able to

CO1 T o Understand the concept of Entrepreneurship

CO2 To Identify, create and analyze entrepreneurial opportunities.

CO3 To Assess techno economic feasibility of a Business Plan

CO4 To Create Business Plans

CO5 To State various statutory institutions involved in the process of Entrepreneurship development

Text books:

1. Madhurima Lall and Sultan Ahmad (2021). Fundamentals of Entrepreneurship and Project Planning. S. Chand & Sons.
2. Bhatia. RC (2020). Entrepreneurship: Business and Management. S. Chand & Sons.
3. Nitin Zaware, Shilpa R Kankonkar and Yogesh S. Daudkhane (2019), Entrepreneurship Development. Thakur Publications Pvt. Ltd.

Web References:

1. https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introduction- to-entrepreneurship/
2. https://articles.bplans.com/10-great-websites-for-entrepreneurs/
3. https://www.entrepreneur.com/article/272185

24DVAC51 **MUSHROOM CULTIVATION**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVE:

To learn the cultivation of various mushrooms and to create the student for self-employment

UNIT 1: MUSHROOM BIOLOGY 5

Introduction to Mushroom - History of Mushroom - Ecology of Mushroom -Life cycle of Mushroom. Identification of Mushrooms - Phylogeny of Mushrooms.

UNIT 2: CULTIVATION METHODS 7

General preparation for Mushroom Cultivation. - Basic elements for Mushroom growth and farm settings - Basic elements for Mushroom growth and farm settings - Cultivation methods (*Agaricusmorcella*, *Volvariella* and *Pleurotus*)

UNIT 3: VALUE OF MUSHROOM 6

Production of Mushrooms from waste substrates. Rice bran, Ground nut, Sugar cane trash. Mushrooms in food and medicine. Nutritional and medicinal value of mushrooms.

UNIT 4: COMPOUNDS FROM MUSHROOM 6

Production of Mushrooms enzymes and metabolites and Preparation of other value added products from Mushroom. Diseases and Pest control.

UNIT 5: MUSHROOM MARKETING 6

Postharvest technology, marketing strategies of mushroom with special reference to export and local marketing.

Total hrs: 30

COURSE OUTCOME:

CO –1: Student will understand what is mushroom and where the mushroom is present

CO –2: To understand mushroom lifecycle and how to identify different types of mushrooms

CO –3: Student will learn how to cultivate mushroom and its basic elements of preparation

CO –4: Student will learn about the cultivation methods of (Agaricus morcella, Volvariella and Pleurotus)

CO –5: Student will understand the nutritive and medicinal values of mushrooms

CO –6: Student will learn about the post harvest technology of medicinal plants.

Text and Reference Books:

1. Sabarathnam, V. & Ramasamy, G. (2021). *Medicinal Mushrooms: An Overview*. Elsevier.
2. Chakravarty, A. & Choudhury, S. (2018). *Mushroom Cultivation and Processing*. Academic Press.
3. Hait, S. & Das, S. (2020). *Fungi: Biology, Applications, and Biotechnological Impacts on Food and Agriculture*. Springer Nature.
4. Kumari, P. & Kumar, M. (2016). *Mushroom Cultivation for Food and Industry*. Springer.
5. Subrata Biswas, M. Datta, S.V. Ngachan. (2012). Mushrooms: A Manual for Cultivation. PHI Learning Private limited, New Delhi.
6. Jagtap, G., & Dey, U. (2012). *Mushroom Cultivation*. LAP Lambert Academic Publishing.
7. Tripathi, D.P. (2005). *Mushroom Cultivation*. Oxford and IBH Publishing Company Pvt. Limited.

24IBBT51 **INTERNSHIP II**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

• For the benefit of the students, it has been mandatory to attend a minimum of one internship during semester vacation

• Student should go for Internship in any biotechnological industry or laboratories and learn their laboratory techniques by hands on training.

• After the Internship, student should submit detailed reports about the Internship in printed format.

• Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

• The report will be evaluated by duly appointed teaching faculty from head of department.

SEMESTER VI

24CBBT61 **BIOINFORMATICS**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To understand the application of various tools of bioinformatics

UNIT I INTRODUCTION OF BIOINFORMATICS 9

Overview and Definition, Application of Bioinformatics, Sequences format used in Bioinformatics- Biological Database: Introduction, Classification of biological databases, Primary database- Nucleic acids- NCBI-DDBJ-EMBL. Protein- PDB- SWISSPORT. Secondary database- PROSITE, PFAM. Structure and classification-SCOP CATH, Metabolic pathway database.

UNIT II: SEQUENCES ANALYSIS 9

Sequences similarity, Identify & homology- Definition of homologues, Orthologues, Paralogues. Scoring matrices, Pairwise Sequences alignment. Dot Matrix, BLAST, FASTA- Needleman Wunsch – Smith and waterman Algorithm.

UNIT III: DRUG DISCOVERY 9

History of Drug Discovery, Steps in Drug design – Target Identification- Target validation- Lead Identification- Lead Optimization- Clinical Trials and Phases. Chemical libraries – Role of molecular docking in drug design.

UNIT IV: PROTEIN PREDICTION 9

Tools for primary (Compute PT/Mw, Protparam), secondary (PROSITE), Tertiary (Swiss Model), Structure prediction of proteins, Homology modelling of proteins. Visualization tools (RASMOL), Gene prediction tools (Genscan, Grail). Phylogenic trees-rooted and unrooted tree-Methods to generate phylogenetic tree-Tools for multiple sequences alignment and phylogenetic analysis (PHYLIP).

UNIT V: COMPUTER APPLICATIONS 9

Computer Systems: characteristics of a computer, components of a computer system – CPU, memory, storage devices and I/O devices - Memory: primary (RAM and ROM) and secondary memory. Storage devices: hard disk, CD ROM, DVD, pen/flash drive, memory stick. I/O devices:

keyboard, mouse, monitor, printer, scanner, web camera. MS Office- Word, Excel PowerPoint – Use of Artificial Intelligence

Total Hour: 45 Hours

Course Outcomes:

CO-1: Understand bioinformatics applications and database formats

CO-2: Analyse biological sequences using BLAST and FASTA

CO-3: Crating and adapting the method for drug designing and docking

CO-4: Explain on the steps involved in clinical trials for drug discovery.

CO-5: Demonstrate the database for phylogeny analysis and Protein Prediction

CO-6: Understand about the Visualization tools for protein prediction.

CO-7: Illustrate on the basic components of computers

CO-8: Analyse biological data with MS Office and understand various input/output devices.

Text and Reference Books:

1. Attwood, T.K. & Parry-Smith, D.J. (2021). Introduction to Bioinformatics. Pearson.
2. Baxevanis, A.D. & Ouellette, B.F. (2020). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley.
3. Kuhn, M. (2018). Applied Bioinformatics: The Data Analysis Guide for Biomedical Researchers. Springer.
4. Lesk, A.M. (2019). Introduction to Bioinformatics. Oxford University Press.
5. Zhang, Z. & Wei, L. (2017). Bioinformatics: Tools and Applications. Springer.
6. Ranjan, R. (2016). Bioinformatics and Functional Genomics. Wiley-Blackwell.
7. Rastogi, S.C, Mendiratta, N, Rastogi, P.,(2004) . Bioinformatics methods and application. Prentice-Hall of India private limited, New Delhi.
8. David Mount., (2009). Bioinformatics: sequence and genome analysis, second edition., Taylor & Francis, UK.
9. D.R. Westhead. (2009). Instant Notes in Bioinformatics., second edition., Taylor & Francis, UK; 2009.

Useful Website:

WWW.expasy.org

L	T	P	O	C
4	0	0	2	4

24CBBT62 **STEM CELL BIOLOGY**

COURSE OBJECTIVE:

To study the characteristics, functions, sources, mutations, and applications of stem cells and the ways to manipulate them for human benefit.

UNIT I STEM CELLS – INTRODUCTION 12

Introduction to stem cells – Definition and Properties, Proliferation, Culture of stem cell - Application of stem cells – Bioethics and legal issues in stem cells.

UNIT II TYPES OF STEM CELLS 12

Totipotency, Pluripotency, Types of Stem cell, Embryonic stem cell, Pluripotent Stem Cells, Adult Stem Cell, Induced Pluripotent Stem Cell.

UNIT III ISOLATION OF STEM CELL 12

Growth Factors, Chord Cells, Derivation & Differentiation of Embryonic stem cell, Derivation & Differentiation of Pluripotent cells, Induced Pluripotent Stem Cell – methods, FACS.

UNIT IV STEM CELLS IN TISSUE ENGINEERING 12

Tissue Engineering triangle, Role of growth factors, Biomaterials and Scaffolds in Tissue Engineering. Requirement of biomaterials as tissue engineering scaffold. properties and types of scaffolds, tissue specific scaffolds; Methods of scaffold design/preparation. Cell-ECM/Scaffold interactions, Animal cell culture on scaffolds.

UNIT V APPLICATION OF STEM CELLS 12

Tissue and organ transplantation. Bio-artificial organs: Skin Tissue engineering, Liver tissue engineering, Bladder reconstruction, Kidney tissue engineering, Bone and cartilage tissue engineering, and Cardiovascular tissue engineering.

Total Hour: 60 Hours

Course Outcomes:

CO-1: Compare different types of stem cells.

CO-2: Understand about Bioethics and legal issues in stem cells.

CO-3: Improve the mechanistic interpretation of stem cell self-renewal, proliferation, and differentiation.

CO-4: Assess and interpret the basis for the origin, metastatic potential, relapse, and treatment strategies.

CO-5: Demonstrate the role of stem cells in tissue engineering.

CO-6: Illustrate about the scaffold and its significance in tissue engineering

CO-7: Prioritize and rephrase the application of stem cells and current issues and challenges in tissue engineering.

Text and Reference Books:

1. Mora, R., & Atala, A. (2021). Principles of Stem Cell Biology and Regenerative Medicine. Elsevier.
2. Lanza, R., & Cibelli, J. (2020). Handbook of Stem Cells: Volume 1 and 2. Academic Press.
3. Brockes, J.P., & Kumar, A. (2019). Stem Cells: From Development to Therapy. Wiley-Blackwell.
4. Trounson, A., & McDonald, C. (2018). Stem Cells in Regenerative Medicine: Science, Regulation and Business Strategies. Springer.
5. Shroff, G. (2018). Stem Cell and Regenerative Medicine. Elsevier.
6. Scott F. Gilbert, Susan Singer (2006). Developmental Biology. Eighth Edition, Publisher: Sinauer Associates.
7. Robert Lanza, James A. (2009). Essentials of Stem Cell Biology 2nd edition. Academic Press USA.

24CBBT63 **MICROBIAL BIOTECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

To impart knowledge on types of microorganisms used in the field of Biotechnology for product development.

UNIT I INTRODUCTION 10

General concepts of microbial biotechnology. Genetic engineering of microbes for the production of antibiotics, enzymes, insulin, growth hormone and monoclonal antibodies. Synthetic bacteria. Microorganisms as factories for the production of novel compounds.

UNIT II INDUSTRIAL PRODUCTION 12

Industrial production of alcohol, acetic acid, antibiotics (Penicillin and streptomycin), enzymes (Amylases and Proteases), amino acids (lysine and glutamic acid), vitamin B12. Microbial biomass production - algal (SCP), fungal (mushroom), yeast (baker's yeast). Production of bioplastics

UNIT III MICROBIAL INOCULANTS 15

Selection and establishment of nitrogen fixing bacteria. Production of Rhizobium, Azotobacter, Azospirilla, cyanobacteria and other nitrogen fixing bacterial cultures. Quality control of bioinoculants; Phosphate solubilizing bacteria; Plant growth promoting rhizobacteria (PGPR). Production of biofertilizers and biopesticides for large scale applications.

UNIT IV APPLICATION I 12

Industrial uses of microbes — Role of microorganisms in fermented products - Dairy and non-Dairy products- fermented foods, Microbial production of yoghurt, cheese, beer and wine. Microbial fermentation of tea, coffee and cacao. Biopolymers, Biosurfactants, Bioremediation.

UNIT V APPLICATION II 11

Microbial leaching of ores, Bioweapons and Bioshields, Microbial fuel cells. Microbial fuels (biohydrogen, bioethanol and biomethane), Nutraceuticals from algae, Algal Pigments and Genetics of secondary metabolite production

Total Hour: 60

COURSE OUTCOME

CO-1: Understanding and gaining knowledge on genetically modified microbes

CO-2: Illustrate on the production of novel and pharmaceutically compounds from microbes.

CO-3: Concepts related to Microbial production of therapeutically important products

CO-4: Significance of microbes in agriculture

CO-5: Apply knowledge of microorganisms in the commercial production of flavours, fragrances, and microbial pigments in textile and industry

CO-6: Analyze the Scope of Microbial Biotechnology

CO-7: Understand the steps involved in the production of biofuel from microbes.

TEXT & REFERENCE BOOKS:

1. Singh, J., Vyas, A., Wang, S., & Prasad, R. (2020). Microbial Biotechnology: Basic Research and Applications. Springer Nature, Singapore.
2. Rastegari, A. A., Yadav, A. N., & Yadav, N. (2019). New and Future Developments in Microbial Biotechnology and Bioengineering. Elsevier, Amsterdam.
3. Lee, Y. K. (2015). Microbial Biotechnology: Principles and Applications (3rd ed.). World Scientific Publishing, Singapore.
4. Ray, R. C., & Roselló, J. (2014). Microorganisms and Fermentation of Traditional Foods. CRC Press, Boca Raton, FL.
5. Pandey, B. N. (2012). An Introduction to Biotechnology: The Science, Technology and Medical Applications. McGraw-Hill, New Delhi.

WEB LINKS

https://www.classcentral.com/course/swayam-principles-of-downstream-techniques-inbioprocess-3967

https://www.classcentral.com/course/swayam-industrial-biotechnology-14122

https://onlinecourses.nptel.ac.in/noc19_bt31/preview

24CBBT64 MEDICAL CODING AND CLINICAL RESEARCH

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

This paper was designed to understand the basics of medical coding, clinical research and its ethics.

UNIT I: HUMAN ANATOMY 13

Introduction to Human Anatomy: Musculoskeletal System, Respiratory system, Cardiovascular System, Digestive and Excretory System, Urinary System, Reproductive System, Nervous system, Endocrine System, Hemic and Lymphatic System

UNIT II: INTRODUCTION TO MEDICAL TERMINOLOGY AND CODING 12

Basic concept of medical terminology and coding – History and usage of each coding system – Etymon and derivatives, Greek and Latin origins of medical terms, other sources of medical term. Components of medical terms – word roots, prefixes and suffixes – derivation of medical terms – symbols, colours, numerals & abbreviation – convention for combining morphemes and the formation of plurals.

UNIT III: MEDICAL CODING 12

Code sets overview of the code sets and access to available resources for them – ICD-9, ICD-10, CPT®, HCPCS Level II.

UNIT IV: INTRODUCTION TO CLINICAL RESEARCH 12

Clinical trial terminologies, Drug discovery & development, CPCSEA guidelines & pre-clinical trials, Introduction to toxicity studies, Definition of clinical trial, History of Clinical research, Different phases of clinical research.

UNIT V: ETHICS, REGULATION AND GUIDELINES IN CLINICAL RESEARCH 11

Historical guidelines in Clinical Research, International Conference on Harmonization (ICH), Guidelines for good clinical practice, Introduction to Clinical Trial Regulation, ICMR guidelines.

Total Hour: 60 Hours

Course Outcome:

CO-1: Importance of Human Anatomy for Coding process.

CO-2: Understand on the Basic concept of medical terminology and coding

CO-3: Illustrate about the transcription and ICD principles.

CO-4: Identify medical coding guidelines and understand the coding rule

CO-5: Explain on CPCSEA guidelines & pre-clinical trials

CO-6: Understand the Introduction to clinical research

CO-7: Analyze the regulation and guidelines of clinical research

CO-8: Understanding on International Conference on Harmonization (ICH) and , ICMR guidelines.

Text and Reference Books:

1. Ann Ehrlich and Carol L. Schroeder. (2019). Medical Terminology for Health Professions. Cengage Learning
2. Martini and Nath. (2018). Fundamentals of Anatomy and Physiology Modified Mastering A&P Access Code. Pearson, San Francisco, CA. 11thed., 2018
3. Karen Smiley (2017). Medical Coding and Billing For Dummies. Wiley.
4. Vikas Dhikav Dr (2016) Text Book of Clinical Research, Edition 1st, Publisher AITBS India. ISBN: 978-93-7473-594-7.
5. V. K. Sharma (2016). Clinical Research: A Practical Guide. Jaypee Brothers Medical Publishers.
6. Edward, L. D., Fletcher, A. J., & Fox, A. W. (Eds.). (2007). *Principles and Practice of Pharmaceutical Medicine* (2nd ed.). Wiley.
7. Karen Smiley, (2012). "Medical Coding and Billing for Dummies", 2nd, 2012.

21PBBT61 **PRACTICAL IX - BIOINFORMATICS**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVE:

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

List of Experiments:

1. Introduction to sequence databases Protein sequence databank – UNIPROT. Nucleic acid sequence databank – Gene bank, EMBL, DDBJ.

2. Sequence alignment BLAST, FASTA Pairwise alignment- Needleman-Wunsch and Smith-Waterman algorithms multiple alignment- CLUSTALW, CLUSTAL X, TCOFFEE.

3. Evaluation of protein structure by Swiss PDB viewer and visualization tools – RASMOL.

4. Homology modeling of a given protein sequence

5. Tools of bioinformatics : Primer designing, SNP analysis, String analysis, bankit

6. Molecular Docking – Autodock

Total : 30 Hours

Course Outcome:

CO-1: Learn about sequence database for analysing nucleic acid

CO-2: Understand about pairwise alignment and multiple alignment

CO-3: Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics

CO-4: Existing software effectively to extract information from large databases and to use this information in computer modelling

CO-5: Analyse about tools used in bioinformatics and molecular docking

Text and Reference Books:

1. 1. Baxevanis, A.D. & Ouellette, B.F. (2020). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley.
2. Lesk, A.M. (2019). Introduction to Bioinformatics. Oxford University Press.
3. Kuhn, M. (2018). Applied Bioinformatics: The Data Analysis Guide for Biomedical Researchers. Springer.
4. Zhang, Z. & Wei, L. (2017). Bioinformatics: Tools and Applications. Springer.
5. Ranjan, R. (2016). Bioinformatics and Functional Genomics. Wiley-Blackwell.
6. Rastogi, S.C, Mendiratta, N, Rastogi, P.,(2004) . Bioinformatics methods and application. Prentice-Hall of India private limited, New Delhi.
7. David W. (2001). Mount, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbour Laboratory Press, New York
8. Ignacimuthu, S.J, (2005). Basic Bioinformatics, Narosa Publishing House, Chennai.

24SBBT61 **MINI PROJECT**

L	T	P	O	C
0	0	4	1	2

Course Objectives:

• For the benefit of the students, it has been mandatory to attend a Mini project during semester vacation

• Student should go for Mini project in any biotechnological industry or laboratories and learn their laboratory techniques by hands on training.

• After Mini project, student should submit detailed reports about the Internship/ Mini project in printed format.

• Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

• The report will be evaluated by duly appointed teaching faculty from head of department.

SEMESTER VII

24CBBT71 PHARMACEUTICAL BIOTECHNOLOGY

L	T	P	O	C
3	0	0	2	3

Course Objective: (Employability)

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

UNIT I BASICS OF PHARMACOLOGY **10**

History and Principle of pharmacology. Basics of Pharmacology, Drug Action & Metabolism: Drug names and Classification systems. Route of drug administration, pharmacodynamics, pharmacokinetics – Absorption, Distribution, Metabolism and Excretion of drugs / metabolites, pro-drugs, protein binding of drugs.

UNIT II DRUG AND ITS TREATMENTS **8**

Chemo therapeutic drugs- Protein synthesis inhibitors, Anti-bacterial, anti-fungal, anti- Protozoal, antiviral, anticancer, anti-inflammatory drugs, Production of Ergot, Probiotics.

UNIT III DRUG DEVELOPMENT PROCESS **8**

Discovery of biopharmaceuticals – pharmacogenetics - pre-clinical studies - Toxicity studies – reproductive toxicity and teratogenicity, mutagenicity, carcinogenicity and other tests, clinical trials, clinical trial design, trial size design and study population. Drug development and delivery - drug carrier -Recombinant drugs.

UNIT IV DOSAGE FORMS **10**

Principles of Drug Manufacture: Solid dosage forms – introduction to types of tablets, excipients, granulation techniques, compression machinery, processing problems, Coated tablets - types – enteric coated tablets, film coated tablets and sugar-coated tablets. Evaluation of coated tablets. Production of hard and soft gelatine capsules, liquid dosage form – suspension and emulsion. Semisolid dosage form – ointment, GMP.

UNIT-V APPLICATION **9**

Biopharmaceuticals and Bioactivity: Various categories of therapeutics like Laxatives, Analgesics, Contraceptives, Antibiotics and Hormones. Biochips, Biofilms, Biosurfactants. Applications of Nanotechnology in drug development and delivery.

Total Hour: 45

COURSE OUTCOMES:

CO-1: Learn about basics of pharmacology and their metabolism.

CO-2: Knowledge about drugs and its treatment for various organisms.

CO-3: Apply the drug development process and its application in production oftherapeutic proteins.

CO-4: Formulate new drug formation and principles of manufacturing.

CO-5: Evaluation of different types of tablets and the steps involved in its production/

CO-6: Illustrate on the various categories of biopharmaceuticals produced.

CO-7: Understand the Application of Nanobiotechnology in drug development.

TEXT AND REFERENCE BOOKS:

1. Gola, D. (2019). Pharmaceutical Biotechnology: Fundamentals and Applications. Elsevier Publishing.
2. Walsh, G. (2018). Biopharmaceuticals: Biochemistry and Biotechnology. Wiley-Blackwell.
3. Jay P Rho, Stan G Louie, (2003). Hand book of Pharmaceutical Biotechnology, Pharmaceutical products press, New York. 2003.
4. Pardridge, W. M. (2017). Pharmaceutical Biotechnology: Drug Discovery and Development. Springer.
5. Swann, R., & Bansal, A. (2017). Pharmacology and Pharmacotherapeutics. Jaypee Brothers Medical Publishers.
6. Vyas, S. P., & Khar, R. K. (2016). Pharmaceutical Drug Delivery Systems: Design and Development. CBS Publishers & Distributors.
7. Rao, M. (2020). Nanotechnology in Drug Delivery. CRC Press.
8. Satoskar, R. S., S. D. Bhandhakan and S. S. Alinaoure, (2000). Pharmacology and Pharmacotherapeutics. 17th Edition, Popular Prakashan Publishers, Mumbai.
9. Daan, J. A., Crommelin and R. D. Sindelar, (2002). Pharmaceutical Biotechnology. Routledge Taylor and Francis Inc, New York. 3rd Edition, 2002.
10. Sethi, P.D., (2005). Quantitative Analysis of Drugs in Pharmaceutical Formulations. 3rd Edition, CBS Publishers and Distributers. New Delhi.

24CBBT72 **OMICS TECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

Course Objective (Employability):

To provide the students a broader knowledge of omics concepts and technologies.

UNIT I INTRODUCTION TO GENOMICS **12**

Genome mapping – Physical and Genetic Map, Genome Sequencing, Next generation sequencing method, Genome Annotation, Functional Genomic methods – Genetic interaction mapping.

UNIT II TRANSCRIPTOMICS **12**

Transcription factor and its binding sites, RNA – Sequence, Regulatory RNAs small or large, candidate gene approach – Northern Blotting Analysis, Real time RT-PCR, Hybridization based approach – Microarray expression profiling, Sequenced based approach – EST libraries, SAGE, CAGE.

UNIT III METABOLOMICS **12**

Introduction to metabolomics – Targeted and untargeted metabolomics**,** Tools used in metabolomics study **–** Gas chromatography, Capillary Electrophoresis, High performance Liquid Chromatography, NMR and MS**.**

UNIT IV PROTEOMICS **12**

Introduction – Structural Proteomics, Functional proteomics, Expression proteomics, Protein separation – SDS-PAGE, 2-DE (Gel-based approach), LC, RP-LC, Immuno affinity (off-gel based), iTRAQ, ICAT, SILAC (Quantitative), MS – MALDI.

UNIT V OTHER "OMICS" STUDY **12**

Lipidomics, Glycomics, Epigenomics, Foodomics, Pharmacogenomics, Phenomics, Ionomics etc.

Total Hour: 60

COURSE OUTCOME:

CO-1: Understand the organization of genomes and analyse the tools for genome analysis.

CO-2: Interpret the list of microarray techniques and their applications.

CO-3: Understand the concept of Transcription factor and techniques for its analysis.

CO-4: Analyze the importance of milestones in sequencing methods and functional analysis.

CO-5: Learn about proteomic technologies and protein-protein interaction studies.

CO-6: Illustrate on the techniques involved for analysis of proteins.

CO-7: Understand metabolomics techniques and their applications.

CO-8: Analysis of other Omics studies apart from genomics, proteomics and metabolomics

TEXT & REFERENCE BOOKS

1. Chatterjee, A., & Bandyopadhyay, S. (2020). Omics Technologies: Applications in Health, Disease, and Environment. Elsevier.
2. Kumar, S., & Sharma, A. (2021). Pharmacogenomics: An Introduction to the Study of the Role of Genomics in Drug Response. CRC Press.
3. Weckwerth, W., & Möller, M. (2020). Metabolomics: From Fundamentals to Applications. Wiley-VCH.
4. Pardee, A. B., & Larkin, C. (2019). Transcriptomics: A Guide to RNA Sequencing and Its Applications. Springer.
5. Ghosh, S. (2017). Genomics and Proteomics: Modern Analytical Techniques. Wiley-Blackwell.
6. Brown T. A., Genomes (2017). Garland Science Publishing, 4th Edition. New York,
7. Dunham, I., (2003).Genome Mapping and sequencing. Horizon Scientific,
8. Hartwell, L. H., L. Hood, M. L. Goldberg, A. E. Reynolds, L. M. Silver and R. G. Veres. (2003). Genetics from Genes to Genomes. McGraw Hill., 2004 Lewin B. Genes VIII. Oxford University Press. Oxford.
9. Primrose, S. B., and. Twyman. R M., (2006). Principles of gene manipulation and Genomics, 7th Edition, Blackwell Publishing MA. USA, ,
10. Nawin C. M., Günter B,(2010). Introduction to Proteomics: Principles and Applications, 2010.
11. Griffiths WJ, (2008). Metabolomics, Metabonomic and Metabolite Profiling, (The Royal Society of Chemistry UK) ISBN 978-0-85404-299-9.

24CBBT73 **TISSUE ENGINEERING**

L	T	P	O	C
4	0	0	2	4

Course Objectives (Skill Development)

The learners will understand the strategies and techniques involved in tissue engineering and its applications

UNIT I INTRODUCTION TO TISSUE ENGINEERING **11**

Overview of tissue engineering: definition, history, and significance - Fundamentals of cell biology and tissue structure - Biomaterials in tissue engineering: properties and selection criteria - Cell sources for tissue engineering: primary cells, stem cells, and cell lines

UNIT II BIOMATERIALS AND SCAFFOLD DESIGN **15**

Properties of biomaterials: mechanical, chemical, and biological properties - Scaffold design principles: pore size, porosity, surface properties, and degradation kinetics - Techniques for scaffold fabrication: electro spinning, 3D printing and self-assembly - Scaffold characterization methods: microscopy, spectroscopy, and mechanical testing - Biomimetic approaches in scaffold design: mimicking native tissue architecture and functionality.

UNIT 3: CELL CULTURE TECHNIQUES **12**

Basics of cell culture: cell isolation, expansion, and maintenance - Cell culture substrates and surface modifications for tissue engineering applications - Bioreactor systems: types, principles, and applications in tissue engineering - Co-culture and organoid culture techniques.

UNIT 4: TISSUE ENGINEERING STRATEGIES **12**

Scaffold-cell interactions: cell adhesion, migration, and differentiation - Growth factors and cytokines in tissue engineering: signaling pathways and delivery strategies – De-cellularization and re-cellularization techniques – Immuno-modulatory strategies

UNIT 5: TISSUE ENGINEERING APPLICATIONS **10**

Clinical applications of tissue engineering - Case studies of tissue-engineered products and therapies - Emerging trends and technologies in tissue engineering: organ-on-a-chip, bioprinting, and gene editing - Ethical implications and societal impacts of tissue engineering advancements.

Total Hour: 60

COURSE OUTCOME:

CO-1: Understand the fundamentals of tissue engineering and biomaterials in tissue engineering

CO-2: Analyze the properties of biomaterials and techniques for scaffold design

CO-3: Importance of cell culture techniques in tissue engineering

CO-4: Understand the role of Bioreactor systems in tissue engineering

CO-5: Interpret the tissue engineering strategies.

CO-6: Illustrate the Immunomodulatory techniques in tissue engineering

CO-7: Adapt the knowledge about tissue engineering applications

CO-8: Explain on the Ethical implications and societal impacts of tissue engineering.

TEXT AND REFERNCE BOOKS:

1. Lanza, R., Langer, R., Vacanti, J. P., Atala, A. (Eds.). (2020). Principles of tissue engineering. Academic press.
2. John P. F., Antonios G. M., Joseph D. B., Donald R. P. (2017). Tissue Engineering: Principles and Practices. CRC Press.
3. Robert L., Robert L., Joseph V. (2014). Principles of Tissue Engineering. Fourth Edition.
4. Palsson, B., Hubbell, J. A., Plonsey, R., Bronzino, J. D. (2003). Principles and applications in engineering series. Tissue Engineering, CRC Press, Boca Raton, FL
5. Clemens van B. (2008), Tissue Engineering, Academic Press.
6. Peter X. M., Jennifer E. (2005). Scaffolding In Tissue Engineering. CRC Press.
7. Buddy D. R., Allan S. H., Frederick J. S., Jack E. L. (2013). Biomaterials Science: An Introduction to Materials in Medicine. Third Edition

24PBBT71 PRACTICAL IX - PHARMACEUTICAL BIOTECHNOLOGY

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES: (Employability)

To learn and understand the principles behind the qualitative and quantitative estimation of phytochemicals. Synthesis of drugs, isolation of bioactive components from natural products and laboratory analysis of the body fluids.

LIST OF EXPERIMENTS:

1. Qualitative analysis of Phytochemicals.
2. Quantitative Estimation of total phenols.
3. Quantitative Estimation of tannins.
4. Quantitative Estimation of alkaloids
5. Separation and Identification of Phytochemicals using TLC & Column chromatography.
6. Preparation of Aspirin
7. Identification of organic compound: Carbohydrate, alcohols, Phenols, Aldehydes and ketones.
8. Isolation of pectin from orange peel and lemon peel
9. Isolation of citric acid from lemon fruits
10. Determination of iodine, Acid and Peroxide and Saponification values.

Total Hours: 30

COURSE OUTCOMES:

CO-1: Understand the basic principles of phytochemical identification and estimations

CO-2: Experiment knowledge in synthesis and identification of drugs.

CO-3: Choose expertise in isolation of bioactive constituents from natural products.

CO-4: Knowledge about isolation of pectin and citric acid from natural source.

CO-5: Determine of different oil value for identification of good product

TEXT AND REFERENCE BOOKS:

1. Gola, D. (2019). Pharmaceutical Biotechnology: Fundamentals and Applications. Elsevier Publishing.
2. Walsh, G. (2018). Biopharmaceuticals: Biochemistry and Biotechnology. Wiley-Blackwell.
3. Jay P Rho, Stan G Louie, (2003). Hand book of Pharmaceutical Biotechnology,

Pharmaceutical products press, New York. 2003.

4. Swann, R., & Bansal, A. (2017). Pharmacology and Pharmacotherapeutics. Jaypee Brothers Medical Publishers.
5. Palanivelu, P., (2001). Analytical Biochemistry and Separation Techniques, Kalaimani Printers, Madurai.
6. Harris, D.C. (2003). Quantitative Chemical Analysis. W. H. Freeman, New York. VI Edition.
7. Sethi, P.D., (2005). Quantitative Analysis of Drugs in Pharmaceutical Formulations. III Edition, CBS Publishers and Distributers. New Delhi.

L	T	P	O	C
0	0	12	4	6

24RBBT71 **RESEARCH PROJECT -I**

REGULATIONS

- Student should do research on their own interest or the interest of their research guide on any biotechnology topic for 6 months in the Uuniversity or any Industries or Laboratories.
- The candidates shall undertake the major project work in the Sixth Semester either in the Department concerned or in industries, institutes or any other organizations and the project report shall be submitted at the end of the Sixth semester.
- In case the candidate undertakes the project work outside the Department, the Staff concerned within the Department shall be the Main guide and the Staff/Scientist under whom the work is carried out will be the Co-guide. The candidate shall bring the attendance certificate from the place of project work carried out.
- After the research, he/she should submit the detailed reports about the research in a format of dissertation and should present with an external examiner.
- Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.
- The report will be evaluated by duly appointed teaching faculty by the Head of the Department

SEMESTER VIII

24CBBT81 **FOOD BIOTECHNOLOGY**

L	T	P	O	C
3	0	0	2	3

Course Objective: (Entrepreneurship)

To provide the knowledge about various Food and nutrients and their functions.

UNIT I BIOTECH FOODS AND SUPPLEMENTS 8

Introduction to food biotechnology and related industries; transgenic plant foods: quality improvement of the food crops by genetic engineering, safety of GM food crops. Dietary supplements; Single cell Protein (SCP) production, mushrooms production technology, large scale production of algae and yeast.

UNIT II FOOD ADDITIVES AND PRESERVATIVE TECHNIQUES 10

Food additives- definitions, need for food additives, classification and functions of different additives: thickeners, antioxidants, coloring agents, flavoring agents, sweeteners, emulsifiers, flour improvers; Probiotics: Production & importance of probiotics; Preservation techniques: refrigeration & freezing, dehydration, heating, irradiation, antimicrobial agents used in food preservation; Food adulteration, nature of adulterants, methods of evaluation of food adulterants.

UNIT III MICROBIAL SPOILAGE AND THEIR CONTROL 10

Meat, Poultry, and Seafood; Milk and Dairy Products; Fruits, Vegetables. Food borne diseases: Bacterial food borne diseases- Staphylococcal in toxification, Botulism, Escherichia Coli Diarrhoea) Food Borne Animal Parasites Protozoa – Giardiasis, Amebiasis, Mycotoxins: Aflatoxicosis. Antimicrobial Preservatives, Biologically Based Preservation and Probiotic Bacteria, Physical Methods of Food Preservation

UNIT IV FOOD PRODUCTION 9

Biotechnology related to the food industry –Application of enzyme in meat industry, fruit and vegetable industry, dairy industry (HFCS (High Fructose Corn syrup). Fermented foods –cheese, fermentation of milk – Wine, beer. Technology of baking – dough rheology – preparation of breads, biscuits, pizza.

UNIT V FOOD SAFETY AND QUALITY CONTROL 8

Introduction to concepts of food safety - Hazard analysis and critical control point (HACCP), Role of international regulatory agencies: USFDA and International Organization for Standards (ISO). Indian food laws and standards: Prevention of Food Adulteration (PFA) Act, Fruit Products Order

(FPO), Meat Products Order (MPO), Cold Storage Order (CSO), Role of AGMARK Standard, Bureau of Indian Standards (BIS) and Food Safety and Standards Authority of India (FSSAI)

Total Hours: 45

COURSE OUTCOME:

CO-1: Learn about nutritive value genetically modified crops.

CO-2: Illustrate on the mass production of SCP, Mushroom and the Algae

CO-3: Knowledge about food additives and preservation techniques.

CO-4: Understanding the different physical methods used for food preservation.

CO-5: To know about food borne diseases.

CO-6: Understand the fermentation processes and appreciate the role of microorganisms in Industrial processes.

CO-7: Analyze the importance of Food Safety and Quality Control

TEXT AND REFERENCE BOOKS:

1. Rani, S. (2021). Advances in Food Biotechnology: Processing, Preservation, and Safety. Springer Nature

2. Kumar, V., & Yadav, D. (2017). Biotechnology of Food and Feed Additives. Wiley-Blackwell

3. Kong, X., & Liu, X. (2018). Food Biotechnology: Principles and Applications. Wiley-Blackwell.

4. Jeyaraj, S., & Nandakumar, R. (2020). Food Safety and Quality Systems in Developing Countries. CRC Press.

5. Baskar, G., & Manikandan, M. (2020). Recent Advances in Food Biotechnology and Safety. Academic Press.

6. Patel, A., & Sharma, D. (2022). Food Additives: An Overview. Springer International.

7. Kumar, P., & Bhardwaj, R. (2017). Food Processing and Preservation: New Technologies. CRC Press.

8. Sathishkumar, P., & Agarwal, A. (2021). Biotechnology of Fermented Foods and Beverages. Elsevier

9. Pandey, A., & Soccol, C. (2019). Microbial Biotechnology: Food and Environmental Applications. Springer Nature.

10. Vijayakhader. (2001). Text book of Food Science and Technology, ICAR, New Delhi

11. King, R. D and P. S.J. Chettam, (1986). Food Biotechnology, Elsevier Applied Science, New

12. Joshi, V.K., (1999). Biotechnology-Food Fermentation. Educational Publishers and Distributors, New Delhi.

13. Adam, M.R. and Moss, M.O., (2003). Food Microbiology, New Age International Pub. New Delhi, India

24CBBT82 **MARINE BIOTECHNOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To learn and understand the marine environment, microbes in marine environment, marine organisms, aquaculture, fish and shrimp cultivation

UNIT I INTRODUCTION 9

Introduction: History of Oceanography - Major divisions of marine environment – Composition of sea, estuarine and brackish waters. Marine Ecology: Classification of marine environment. General characteristics of primary biotic divisions - Plankton, Nekton and Benthos.

UNIT II BIOFOULING AND CONTROL TECHNOLOGY 10

Biofouling organisms - Problems associated with biofouling. Biotechnological approach to control biofouling. Bioenergy from marine algae (biofuel) – biorefinery.

UNIT III AQUA FARMING 9

Criteria for site selection for aqua farm-topography, Aqua farm construction, types of aquaculture ponds - brackish water aquaculture – Breeding - Brood stock management – breeding of ornamental fishes - farm and hatchery - fish farming - shrimp farming- Shellfish –Sea food processing.

UNIT IV MARINE PRODUCTS 8

Seaweeds, Bioactive compounds from marine organisms, antibiotics, ß –carotene, agar agar and pearls, green mussel adhesive protein, Chitosan and its applications - GFP, RFP characteristics and their applications. Remote sensing applications in coastal zone management-Territorial water, contagious zone and exclusive economic zone.

UNIT V MARINE POLLUTION 9

Major marine pollutants and types – classification – nature, sources and transportation pathways. Conservative and non-conservative pollutants. Law pertaining to marine pollution. Ocean management – GESAMP, IMO, IUCN, FAO, UNEP, MoEF& CC and MOES.

Total Hours: 45

COURSE OUTCOMES:

CO-1: Understand the basics of marine biology and oceanography

CO-2: Illustrate on the characteristics of primary biotic divisions

CO-3: Gain knowledge about algal importance and its application

CO-4: Make use of aquaculture's importance and improvement

CO-5: Validating ideas of marine contaminants and marine pollution

CO-6: Adapt the importance of marine products and remote sensing.

CO-7: Understand the concepts of Ocean management and the agencies involved in it.

TEXT AND REFERENCE BOOKS:

1. Raj, A., & Muthusamy, K. (2020). Marine Ecology and Biotechnological Applications. Springer Nature.
2. Bajpai, P., & Singh, S. (2021). Marine Biofuels and Biorefinery. Springer International Publishing.
3. Kumar, V., & Pal, R. (2022). Marine Products and Resources: Biotechnology Applications in Aquaculture and Fisheries. *Springer.*
4. Raj, A., & Muthusamy, K. (2020). *Marine Ecology and Biotechnological Applications*. Springer Nature.
5. Jha, A., & Sinha, R. (2018). Marine Microorganisms and Biotechnology: Advances in Research and Applications. Elsevier Science.
6. Patil, V. S., & Nayak, S. (2019). Aquaculture and Marine Biotechnology: Innovations in Breeding and Hatchery Management. CRC Press.
7. Chaturvedi, V. K., & Gupta, A. (2020). Marine Pollution and Management: *Global Perspectives*. Wiley-Scrivener.
8. Reddy, M.P.M., (2001). Descriptive Physical Oceanography. Oxford & IBM 2001.
9. Santhanam, P., A. R. (2015). Thirunavukkarasu and P. Perumal., Advances in Marine and Brackish water Aquaculture. Springer Publications (ISBN 978-81-322-2270-5).
10. Carl J. Sindermann, (2005). Coastal pollution: Effects on living resources and humans (Marine Science Series).
11. Clark, R. B. (2001). Marine pollution, Fifth edition. Oxford University press, New York Inc..

24CBBT83 **RESEARCH METHODOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

To train students on an introductory course on various research methods.

UNIT I RESEARCH PROBLEM 12

Introduction to Research-Research Problem- Research problem Identification- Review of Literature-Research process- Research design- Experimental designs- non-experimental designs- Exploratory; Diagnostic.

UNIT II SAMPLING METHODS 12

Introduction to sampling- Population- Census- Sample – Types – Probability – Non-Probability sampling – Sampling size – Sampling process; Hypothesis and its formulation.

UNIT III DATA COLLECTION 12

Introduction to Data collection- Data Collection Tools- Case studies - Interview – Questionnaire-Schedule-Observation- Scaling techniques – Scale Construction – Rating scales.

UNIT IV HYPOTHESIS TESTING 12

Introduction to Hypothesis - Hypothesis testing – Parametric Hypothesis- non-parametric; Coding, Editing, Tabulation, Analysis, Interpretation.

UNIT V REPORT WRITING 12

Introduction to Report – types - Report Writing - Layout– Contents of Report-Style of the report - Steps in Report writing – Forms of Reports.

Total Hours: 60

COURSE OUTCOME

CO-1: Identify and come up with a research design for a particular problem

CO-2: Understand the different types of research design.

CO-3: Choose the right sampling method for the identified population.

CO-4: Select the right data collection tools for research

CO-5: Understand the different methods to collect data.

CO-6: Propose and test hypothesis.

CO-7: Report the results in required style.

CO-8: Illustrate the steps involved in report writing.

TEXT & REFERENCE BOOKS:

1. Ranjit Kumar. (2020). Research Methodology: A Step-by-Step Guide for Beginners. SAGE Publications.
2. Creswell, J. W., & Creswell, J. D. (2020). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. SAGE Publications.
3. Sekaran, U., & Bougie, R. (2020). Research Methods for Business: A Skill-Building Approach. Wiley.
4. Kothari, C. R. (2019). Research Methodology: Methods and Techniques. New Age International.
5. Neuman, W. L. (2018). Social Research Methods: Qualitative and Quantitative Approaches. Pearson Education.
6. B. Somekh& C. Lewin, (2005), Research methods in the social sciences, Vistara Publications.
7. S. N. Hesse – Biber, (2007), Handbook of Feminist Research, Sage Publications, London
8. V. Desai & R. B. Potter, (2006), Doing Development Research, Sage Publications, New Delhi

24PBBT81 **PRACTICAL XI– FOOD BIOTECHNOLOGY**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVE

To provide the knowledge about various Food products and analyse their nutrients composition. The uses of microbes in various industries.

List of Experiments:

1. Isolation of yeast from starchy contaminated Food sample
2. Isolation and enumeration of Molds from contaminated food sample
3. Isolation and enumeration of Bacteria from contaminated food sample
4. Quality Analysis of Milk- Methylene Blue Test
5. Quality Analysis of Milk- Resazurin Test
6. Identification of foodborne pathogens/contaminants.
7. Water quality analysis by Most Probable Number
8. Analysis of Microbial spoilage in Fruits & Vegetables
9. Analysis of Microorganisms in Red meat, Chicken, Fish &egg
10. Detection of adulteration in milk,Ghee, sugar

Total Hour: 30

COURSE OUTCOME:

CO-1: Analysis about yeast molds and bacteria in the contaminated food

CO-2: Learn to estimate quality of milk

CO-3: Identification the microbes in the water

CO-4: Analysis of Fruits & Vegetables and meat

CO-5: Adapt the techniques for preservation of food

TEXT AND REFERENCE BOOKS:

1. Kong, X., & Liu, X. (2018). Food Biotechnology: Principles and Applications. Wiley-Blackwell.

2. Reddy, L. K., & Poojary, M. M. (2020). Food Quality Analysis: Techniques and Applications. CRC Press.

3. Jeyasekaran, G., & Rajendran, S. (2018). Microbial Food Safety and Quality Control. Wiley-Blackwell.

4. Miller, R., & Starkey, M. (2020). Detection of Foodborne Pathogens: Methods and Applications. Elsevier.

5. Patel, S., & Reddy, K. A. (2017). Food Safety and Microbial Analysis. Wiley-Blackwell.

6. Jay, J.M.,(1992). Modern Food Microbiology, IV Ed. Chapman and Hall, New York, USA.

7.Dubey, R.C. and E. (2004). Maheshwari, Practical Microbiology, S.Chand & Co. Publishers, New Delhi, India.

24PBBT82 **PRACTICAL XII - MARINE BIOTECHNOLOGY**

L	T	P	O	C
0	0	2	1	1

Course Objective:

To learn and understand the marine environment, marine animals and their adaptations, biofouling, and aquaculture.

Experiments:

1. Differentiating Sea, Estuary and Brackish water
2. Isolation of Plankton from Marine environment (Dinoflagellates/Diatoms/ Copepods)
3. Morphology of Nekton from Marine environment (Fish and Shrimp)
4. Morphology of Benthos of Marine environment (Bivalves and Crabs)
5. Barnacles and Biofouling
6. Isolation of Bacteria associated with Barnacles
7. Control of Bacteria causing Biofouling (Antibacterial agents)
8. Collection of seaweeds (Herbarium)
9. Feed preparation for aquaculture
10. Quality analysis of feeds used in Aquaculture (For microbes)
11. Maintenance of Aquarium
12. Visit to Thalassic environment

Total Hours: 30

COURSE OUTCOMES:

CO-1: Understand different marine environment

CO-2: Knowledge on different type of animals and their adaptation in marine environment

CO-3: Identifying biofouling agent and controlling the same

CO-4: Validating the quality of feeds of Aquaculture

CO-5: Maintenance of Aquarium

TEXT AND REFERENCE BOOKS:

1. Michael J. Kennish, (2020), Practical Handbook of Marine Science, IVth Edition, CRC Press. Pp. 528.

2. Rao, P. V., & Shetty, M. (2020). Marine Microbiology: Techniques and Applications. Springer.
3. Patil, A. S., & Alva, V. (2021). Marine Biotechnology: Marine Bioactive Compounds and Applications. Elsevier Science.
4. Milton Fingerman and R. Nagabhushanam, (2000), Recent Advances in Marine Biotechnology, Vol. 4: Aquaculture: Part A: Seaweeds and Invertebrates, CRC Press. Pp. 304.
5. Se-Kwon Kim (Editor), (2013). Marine Microbiology: Bioactive Compounds and Biotechnological Applications, Wiley Publishers, Pp. 530.
6. John Morrissey, (2018), Introduction to the Biology of Marine Life, 11th Ed. Jones and Barnett, Pp. 450.

24RBBT81 **RESEARCH PROJECT II**

L	T	P	O	C
0	0	12	4	6

REGULATIONS

- Student should do research on their own interest or the interest of their research guide on any biotechnology topic for 6 months in the Uuniversity or any Industries or Laboratories.
- The candidates shall undertake the major project work in the Sixth Semester either in the Department concerned or in industries, institutes or any other organizations and the project report shall be submitted at the end of the Sixth semester.
- In case the candidate undertakes the project work outside the Department, the Staff concerned within the Department shall be the Main guide and the Staff/Scientist under whom the work is carried out will be the Co-guide. The candidate shall bring the attendance certificate from the place of project work carried out.
- After the research, he/she should submit the detailed reports about the research in a format of dissertation and should present with an external examiner.
- Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.
- The report will be evaluated by duly appointed teaching faculty by the Head of the Department

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE)

24DBBT11 GOOD LABORATORY PRACTICES

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

Understand GxP principles, WHO guidelines, and quality assurances. Acquire labware maintenance, chemical handling, solution preparation, biosafety, and effective record keeping for laboratory operations.

UNIT I INTRODUCTION TO GxP (GMP, GLP, GCP) 10

GxP-Introduction, definitions, requirements and historical background, WHO guidelines on GLP and GMP, Quality assurances in Good Laboratory Practices, Principles for documentation (SOP).

UNIT II QUALITY STANDARDS AND QUALITY ASSURANCES 12

Quality Standards- Concept of Quality Control Quality Assurance, Quality assurance and quality management in industry, Customer requirement of quality. Usage and maintenance protocols for basic biotechnology lab equipment.

UNIT III LABWARE MAINTENANCE AND CHEMICAL HANDLING 12

Standard Procedures of Labware Handling and Cleaning: methodologies for cleaning glassware and plastic ware. Recommended materials and techniques for effective cleaning. Best Practices for Chemical Usage and Storage: Knowledge and application of safe handling practices for chemicals. Proper labelling and maintenance of chemical stocks

UNIT IV SOLUTION PREPARATION AND RECORD KEEPING 14

Preparation of Solutions and Standards: Safety protocols for handling various solutions and chemicals. Protocols for preparing test reagents, buffers, and mixing chemicals. Preparation of Media and Decontamination Practices. Methods for decontamination and safe disposal of materials. Laboratory Record Writing: Techniques for effective record writing and data collection. Guidelines for reporting and discussing results.

UNIT V BIOSAFETY INTRODUCTION 12

Historical Background, Biosafety in Laboratory/ institution. Laboratory associated infections and other hazards, Assessment of Biological Hazards and levels of biosafety, Primary Containment of Biohazards, Biosafety Levels, Recommended Biosafety Levels for Infectious Agents and Infected Animals, Government of India Guidelines for Industrial hygiene.

Total: 60 Hours

Course Outcome:

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

CO-1: Analyze GxP principles and WHO guidelines to formulate quality assurances in Good Laboratory Practices.

CO-2: Evaluate quality standards and apply best practices for chemical usage and storage in biotechnology laboratories.

CO-3: Implement standard procedures for labware maintenance.

CO-4: Select the procedure for chemical handling to ensure laboratory safety and efficiency.

CO-5: Create protocols for solution preparation and record keeping.

CO-6: Illustrate the steps to enhance accuracy and compliance in laboratory operations.

CO-7: Assess biosafety measures and industrial hygiene practices to mitigate risks associated with laboratory operations.

CO-8: Illustrate on Government of India Guidelines for Industrial hygiene.

Text and Reference Books:

1. Emmet P. Tobin (2016), cGMP starter guide: Principles in Good Manufacturing Practices for Beginners, Create space Independent Publishing Platform.
2. Cooper BN (2017), Good Manufacturing Practices for Pharmaceuticals: GMP in Practice, Create space Independent Publishing Platform.
3. Sarwar Beg and Md Saquib Hasnain (2019), Pharmaceutical Quality by design: Principles and application, Academic press.
4. Andrew Teasdale, David Elder, Raymond W. Nims (2017), ICH quality guidelines- An implementation guide, Biotechnology 9.28.
5. Gajendra Singh, Gaurav Agarwal and Vipul Gupta (2005), Drug regulatory affairs, CBS publication, 2005.
6. Ron S. Kenett, Shelemyahu Zacks, Daniele Amberti (2000), Modern Industrial Statistics: with applications in R, MINITAB and JMP, 2nd Edition, Wiley, January 2014. 3. Marc P. Mathieu, New Drug Development: A regulatory overvie

24DBBT12 SKILLS IN BIOTECHNOLOGY

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

To provide information on the general introduction about different skills in biotechnology. The methods involved food processing, recombinant DNA technology, production of fertilizers, mushroom cultivation and vermicomposting.

UNIT I FOOD TECHNOLOGY 12

Scope of food processing; historical developments; principles of food processing and preservation. Types of micro-organism normally associated with food - mold, yeast and bacteria. Micro-organisms in natural food products and their control, food poisoning and microbial toxins. Food preservation and packaging.

UNIT II RECOMBINANT DNA TECHNOLOGY 12

Principles of genetic engineering and its applications. Gene cloning techniques: restriction enzymes, vectors, and transformation. Genetically modified organisms. Ethical and societal implications of genetic engineering.

UNIT III BIOFERTILIZER TECHNOLOGY 12

An introduction to fertilizers-inorganic fertilizers, organic fertilizers, bio-fertilizers. Identification of microbial species - Rhizobium, Azospirillum, Azotobacters, blue green algae and phosphate solubilisers. Preparation of microbial inoculants - large-scale production of microbes - their application as biofertilizers.

UNIT IV MUSHROOM CULTURE 12

Introduction to mushroom fungi, nutritional value, edible and poisonous mushrooms, medicinal value of mushrooms. Mushroom Cultivation, harvesting, packing and storage. Processing and preservation of mushrooms. Economic value of mushrooms. Value added products of mushroom.

UNIT V: VERMICULTURE 12

Vermicomposting - Definition, introduction and scope: Ecological classification: Humus feeders, Humus formers, leaf mold, top soil and sub soil types. Optimal conditions for Vermiculture - temperature, moisture, pH, soil type, organic matter, Basic components for vermiculture - Culture practices - Vermi wash. Benefits of Vermicomposting.

Total: 60 Hours

Course Outcome:

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

CO-1: Acquire knowledge on the different skills in biotechnology.

CO-2: Learn the basics of different skills like food processing

CO-3: Understand the Principles of genetic engineering and its applications in Biotechnology

CO-4: List out the Ethical and societal implications of genetic engineering.

CO-5: Illustrate the steps involved in mushroom cultivation and value-added products from it.

CO-6: Acquire knowledge on different types of Biofertilizers produced from microbes.

CO-7: Analyze the scope of vermicomposting and the optimum codition required for it and its application in farming.

Text and Reference Books:

1. Food Processing and Preservation- Subbulaksmi G., and Udipi S.
2. Balachandran KK (2001), Post-harvest Technology of Fish and Fish Products. Daya Publ. House.
3. Motsara, I.M.R., Bhattacharyya, P. and Srivastava, B (1995), Biofertilizer Technology, Marketing and Usage- A Source Book-cum-glossary. FDCO, New Delhi.
4. Borkar,S,G, and Patil N.M (2016), Mushroom,A nutritive food and its cultivation, Astral International Pvt.Ltd, New Delhi.
5. Edwards, C.A. and J.R. Lofty (1977), "Biology of Earthworms" Chapman and Hall Ltd., London.
6. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
7. Principles of Food Science, Vol. II- G. Borgstron, Mc. Millan Co. Ltd. London.
8. Rahman MS (2005), Handbook of Food Preservation, 2nd Ed, CRC Press, Sen DP.
9. Wheaton FW & Lawson TB (1985), Advances in Fish Processing Technology. Allied Publ. Processing Aquatic Food Products, John Wiley & Sons.
10. Steven L. Stephenson (2010), The Kingdom Fungi: The Biology of Mushrooms, molds and lichens.
11. Bergerson FJ (1980), Methods for Evaluating Biological Nitrogen Fixation. John Wiley and Sons.
12. Satchel JE (1983), "Earthworm Ecology" Chapman Hall, London.

L	T	P	O	C
4	0	0	2	4

24DBBT21 ENVIRONMENTAL BIOTECHNOLOGY

COURSE OBJECTIVE:

The course is to introduce environmental biotechnology and focuses on the utilization of Microbial processes in waste and water treatment, and bioremediation.

UNIT I INTRODUCTION ON ECOLOGY 12

Definition, principles and scope of ecology. Ecosystem structure and functions, abiotic and biotic component, Animal relationship – symbiosis – commensalisms – mutualism –Antagonism – Antibiosis – Parasitism – Predation – competition, Energy flow, food chain, food web, Ecological Pyramids-types, biogeochemical cycles,

UNIT II TECHNIQUES FOR ENVIRONMENTAL TREATMENT 11

Physical, chemical and biological treatment of waste water. Aerobic processes: activated sludge, oxidation ponds, trickling filter towers, and rotating discs. Anaerobic processes: anaerobic digesters, anaerobic filters and up flow sludge blanket reactors Treatment of industrial effluents: distillery effluent, paper and pulp mill effluent, tannery effluent, textile dye effluent, removal of heavy metals from waste waters.

UNIT III POLLUTION AND THEIR MONITORING 15

Air pollution - natural and anthropogenic sources of pollution, Methods of monitoring and control of air pollution. Water pollution - types sources and consequences of water pollution. Soil pollution - chemical and bacteriological sampling as analysis of soil quality, soil pollution control, Noise pollution - sources of noise pollution, measurement and indices. Marine pollution, sources of marine pollution and its control. Effects of pollutants on human beings, plants, animals and climate.

UNIT IV BIOREMEDIATION 10

Introduction of Bioremediation; advantages and applications; Types of bioremediations, Natural (attenuation), Ex-situ and In-situ, Bioaugmentation and bio stimulation. Biodegradation: Aerobic vs. anaerobic Degradation; Microbial basis of Biodegradation; Biodegradation of Xenobiotics; Microbial degradation of pesticides. Biogas technology, plant design, construction, operation, biogas form organic wastes.

UNIT V WASTE MANAGEMENT 12

Solid waste management methods - Sanitary land filling, Recycling, Composting, Vermi composting, Incineration, Hospital Waste Management, Hazardous Waste Management & Handling rules, 1989 & 2000 (amendments). Hazardous Waste - Control & Treatment. Disaster Management.

Total: 60 Hours

COURSE OUTCOME

CO-1: Basic knowledge of ecology and the importance of microorganisms' role in ecology

CO-2: Understand the wastewater and solid waste treatment.

CO-3: Analyse about pollution and control management

CO-4: Identifying the importance of Bioremediation

CO-5: Explain about the source of marine pollution and its control.

CO-6: Illustrate on Biogas production and design of biogas plant

CO-7: Determine the biotechnological approach for environmental waste management

CO-8: Understand the rules and regulations to handle hazardous waste.

Text and Reference Books:

1. Dubey, R.C., A Textbook of Biotechnology–S. Chand and Co., New Delhi. 5th edition. 2014
2. Sawyer, C.N., Mc Carty, P.L., and Parkin, G.F., Chemistry for Environmental Engineering and Science, TMH Edition, Tata McGraw Hill Co. Ltd.,New Delhi. 5th Edition, 2003
3. Paul. A, Rochelle, Environmental Molecular Biology, Horizon Press. 2001.
4. Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, Industrial and Environmental Biotechnology, Horizon Press. 2006.
5. Agarwal, K.M., Sikdar, P.K. and S. C. Deb, A Text Book of Environment. Mac Millan India Ltd, Kolkatta, India. 2002.
6. Evans, G.M. and J. C. Furlong, Environmental Biotechnology: Theory and Applications. John Wiley & Sons Ltd, West Sussex, England. 2003.
7. Jordening, H.J. and J. Winter, Environmental Biotechnology. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. 2005.
8. Mara, D., The Handbook of Water and Wastewater Microbiology. Academic Press, London, England. 2003

L	T	P	O	C
4	0	0	2	4

24DBBT22 BIOINSTRUMENTATION

COURSE OBJECTIVES:

This course will help students understand the basic and advanced instrumentation techniques focusing on biological investigation and provide ample opportunity for them to specialize in instrumentation.

UNIT I: CENTRIFUGATION TECHNIQUE 12

Introduction - Basic Principles of Sedimentation**.** Principles of centrifugation, Types of Centrifugation techniques—Analytical centrifugation, Density gradient centrifugation, and Differential centrifugation.

UNIT II: CHROMATOGRAPHIC TECHNIQUES 12

General Principles of Chromatography. Types of Chromatography – Affinity chromatography, Column chromatography, Thin Layer chromatography, Gas chromatography, High-performance liquid chromatography and Anion and cation exchange chromatography.

UNIT III: ELECTROPHORESIS TECHNIQUE 13

Introduction, Principles and theory of Electrophoresis, Types of Electrophoresis, Methods of electrophoresis paper, Cellulose acetate strips and Gel electrophoresis. Types of Gel electrophoresis – Horizontal and vertical, Two-dimensional gel electrophoresis. Immuno-electrophoresis.

UNIT IV: SPECTROSCOPY AND MICROSCOPY TECHNIQUE 13

Principles of colorimetry and its types. Principle of spectrophotometer and Instrumentation, Beer Lambert's Law. Types of spectroscopies – UV spectroscopy, Atomic Absorption spectroscopy, FTIR spectroscopy, Mass spectroscopy and Raman spectroscopy. Microscopy- Basic Principle, Types of Microscopies, and Electron microscopy (TEM and SEM)

UNIT V: RADIOISOTOPE TECHNIQUE 10

GM counter, LS counter, Scintillation counter, Autoradiography, Flow cytometry, and FACS. Application in Medicine and Diagnosis.

Total: 60 Hours

COURSE OUTCOME

CO-1: Understand the basics of centrifugation techniques and their types.

CO-2: Understand the basic operating chromatographic technique.

CO-3: Describe various methods of electrophoresis technique.

CO-4: Describe about the spectroscopy techniques and their types.

CO-5: Illustrate on different types of microscopes and their applications.

CO-6: Understanding radio isotopic technique.

CO-7: Explain the application of radioisotopes in medicine and diagnosis

Text and Reference Books:

1. David T. Plummer (2017), An Introduction to Practical Biochemistry, (3rd Edition), Tata McGraw Hill, ISBN 13: 9780070994874.
2. Keith Wilson and John Walker (2010) Practical Biochemistry - Principles and Techniques (7th Edition), Cambridge University Press, U.K, ISBN 978-0-521-73167-6.
3. Upadhayay and Nath (2019), Biophysical chemistry: Principles and Techniques (4thReview Edition). Himalaya publishing house, ISBN Number: 978-93-5142-227-3
4. M.L. Srivastava (2011), Bioanalytical Techniques, Narosa Publishing House, New Delhi, ISBN 13: 9788173198526.
5. Rapley and Walker (2008), Molecular Biomethods Handbook, Humana Press, NewYork.
6. SVS Rana (2018), Biotechniques: Theory & Practice, (Second Edition), Rustogi Publications.
7. Saroj Dua and Neera Garg (2013), Biochemical Methods of Analysis, Narosa Publishing House, New Delhi.

24DBBT31 **ENZYME TECHNOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE

Enzyme Technology delves into the principles and applications of enzymes in various industrial processes. The course explores enzyme kinetics, immobilization techniques, enzyme production, and their utilization in industries such as food processing, pharmaceuticals, biofuels, and environmental remediation

UNIT I FUNDAMENTALS OF ENZYMES 9

General Introduction of Enzymes – Nomenclature of Enzyme and Units of enzyme - Classification of enzymes – Factors influencing enzyme activity – Structure of Enzyme – Enzyme specificity – Metalloenzyme and metal activated enzymes – Coenzymes and cofactors – Prosthetic group.

UNIT II: ENZYME CATALYSIS 9

Hypothesis: Lock and key, Induced fit, and Transition state – Mechanism of enzyme catalysis: Acid-base catalysis, covalent catalysis, Metal ion catalysis, Electrostatic catalysis, Catalysis through proximity and orientation effects. Mechanism of Ribonuclease A, Chymotrypsin, Carbonic anyhydrase, Carboxypeptidase A.

UNIT III: ENZYME KINETICS AND INHIBITION 9

Enzyme Kinetics: Michalies-Mentons (MM) equation, transformation of MM equation, Line- Weaver Burk Plot, and Eadie Hoffste Plot – Effect of pH, temperature, enzyme activity, turn over number of enzymes – Enzyme inhibition: Irreversible, Reversible, Competitive, Uncompetitive – mixed and Non-competitive inhibition. Allosteric and Product inhibition

UNIT IV: ENZYME REGULATION AND PURIFICATION 9

Enzyme Regulation: Feedback regulation, Allosteric regulation, Reversible Covalent modification, and Proteolytic activation – Enzyme isolation and purification – Preliminary and Advanced technique. Enzyme immobilization and its types.

UNIT V: ENZYMES USED IN INDUSTRIAL AND CLINICAL 9

Industrial - Thermophilic enzyme, amylase, lipase, proteolytic enzyme, cellulose degrading enzyme and metal degrading enzyme. Clinical – Liver enzyme (AST, ALT), Cardiac and muscle enzymes

(CK and LDH). Therapeutic enzymes – Asparaginase, streptokinase. Thrombolytic agents and Anti-inflammatory agents.

Total Hour: 45 Hours

Course outcome:

CO-1: Understands the fundamental principle of enzyme structure and function.

CO-2: Explore enzyme kinetics and mechanisms of enzyme-catalyzed reactions.

CO-3: Understand the concept of Enzyme kinetics and factors affecting enzyme activity.

CO-4: Analyze various techniques for enzyme immobilization and their applications.

CO-5: Examine the industrial production of enzyme and its purification

CO-6: Evaluate the different classes of enzyme regulations.

CO-7: Illustrate the applications of enzymes in food, pharmaceuticals industry and bioremediation.

Text and Reference Books:

1. Nelson.D.L, Cox. M. M. Lehninger's Principle of Biochemistry. 4th ed. Freeman, 2004
2. Bajaj, B. K., & Meena, S. (2019). Enzyme Technology: Applications in Industrial Processing and Biotechnology. Springer.
3. Ghosh, A., & Gupta, M. (2020). Industrial Enzymes: Advances and Applications. Elsevier Science.
4. Whitaker, J. R. (2017). Enzyme Chemistry and Applications: From Industrial Enzymes to Therapeutics. Springer
5. Barrett, A. J., & Rawlings, N. D. (2020). Handbook of Enzyme Research: Methods and Applications in Biotechnology. Elsevier
6. Sharma, R., & Gupta, M. N. (2018). Industrial Enzyme Applications: Biochemical and Biotechnological Applications. Springer Nature
7. Wang, L., & Liu, J. (2020). Enzyme Catalysis: Mechanisms, Modeling, and Applications. Elsevier Science
8. Berg.J.M, Tymoczko.J.L, Stryer, L. Biochemistry. 6th ed. Freeman, 2000Dixon & Webb. Enzymes. 3rd ed. Longmans, 1979.
9. Murray. R.K, Granner.D.K, Mayes. P.A, Rodwell. V.W.Harper's Biochemistry. 27th ed. McGraw Hill, 2006.

24DBBT32 **BIODIVERSITY AND ECOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To impart knowledge on Biodiversity, its conservation, concepts of ecology and ecology of communities so as to maintain the sustainability of nature.

UNIT I BIODIVERSITY AND CONSERVATION 9

Introduction- Definition, Diversity types: Genetic diversity, Species diversity, Ecologial diversity. Structural and functional aspects of Biodiversity. Bio-geography of India. Conservation of genetic, species and ecological diversity. Importance of DBT, BSI, NBPGR, ZSI, FSI, NBFGR and NBAGR, NFPTCR in Biodiversity.

UNIT II BIODIVERSITY AND ECOLOGY 9

Intrinsic, consumptive, productive, social, ethical and aesthetic values of Biodiversity. Utilitarian values of biodiversity. Functioning of Biodiversity and ecosystem. Biodiversity and stability of ecosystem. Biodiversity at global, national and local levels of India (Himalayas and Western Ghats). Criteria for determining hot spots.

UNIT III THREATS TO BIODIVERSITY 9

Rare species, habitat loss. Extinction due to over-exploitation, invasive species. Mass extinction, pollution, human interference, ecosystem degradation. Endemic species. Endangered species of plants and animals. Red data book.

UNIT IV ECOLOGY BASIC CONCEPTS 9

definitions: ecology, landscape, habitat, ecozones, biosphere, ecosystems, ecosystem stability, resistance and resilience; autecology; synecology; major terrestrial biomes; phenotypic plasticity; ecotypes; ecoclines; acclimation; ecological niche; Types of ecosystem: forest, grassland, lentic, lotic, estuarine, marine, desert, wetlands; ecosystem structure and function; abiotic and biotic components of ecosystem; food chain, food web; ecological efficiencies; ecological pyramids: pyramids of number, biomass, and energy.

UNIT V BIOGEOCHEMICAL CYCLES AND ECOLOGY OF COMMUNITIES 9

Carbon cycle; nitrogen cycle; phosphorus cycle; sulphur cycle; hydrological cycle; nutrient cycle models; ecosystem input of nutrients; biotic accumulation; ecosystem losses; nutrient supply and

uptake; Community structure and organization: keystone species, ecotone and edge effect; species interactions: positive and negative ecological succession and climax community.

Total Hour: 45

COURSE OUTCOME:

CO-1: Understanding the concept of Biodiversity and its conservation and

CO-2: Explain on the governing bodies of Biodiversity and its roles.

CO-3: Gaining knowledge on Utilization of Biodiversity, its stability and various biodiversity hotspots at global and national level.

CO-4: List out the threats of Biodiversity and its sustainability

CO-5: Understand the importance of endangered species placed in red data book.

CO-6: Understanding the basic concepts of ecology, its types, components and pyramids.

CO-7: Assess the different types of ecosystem and its components

CO-8: Gaining knowledge on Biogeochemical cycles and ecological communities.

Text and Reference Books:

1. Groom. B. & Jenkins. M. 2000.Global Biodiversity: Earth's Living Resources in the 21st Century. World Conservation Press, Cambridge, UK.
2. Díaz, S., & Settele, J. (2020). Biodiversity and Ecosystem Functioning: A New Synthesis. Cambridge University Press.
3. Hughes, R. F., & Chapin, F. S. (2020). Ecology of the Global Environment: Theories and Applications. Wiley-Blackwell.
4. Lal, R. (2021). Soil Ecology and Management for Sustainability: Conservation and Biodiversity Perspectives. CRC Press.
5. Sarkar, S. P., & Biswas, S. (2018). Biodiversity Conservation and Environmental Management. CRC Press
6. Loreau, M. & Inchausti, P. (2002). Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK
7. Gurevitch, J., Scheiner, S. M., & Fox, G. A. (2002). The Ecology of Plants. Sinauer associates incorporated.

8. Pimentel, D. (Ed.). (2011). Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species. CRC Press
9. Singh, J.S., Singh, S.P. & Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.

24DBBT41 **IPR & BIOETHICS**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES

Students will understand the importance of Intellectual Property Rights (IPR), and Ethical Issues in Biomedical Research

UNIT I INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 12

Overview of Intellectual Property (IP) concepts - Types of intellectual property: patents, copyrights, trademarks, and trade secrets - History and evolution of intellectual property laws - Importance of IPR in promoting innovation and creativity.

UNIT II INTELLECTUAL PROPERTY IN BIOTECHNOLOGY 10

Patentability of biotechnological inventions - Case studies on landmark biotechnology patents - Ethical considerations in biotechnology patenting - Access to biotechnological innovations and global implications

UNIT III ETHICAL FRAMEWORKS IN BIOETHICS 14

Introduction to bioethics and its relevance in life sciences - Major ethical theories: utilitarianism, deontology, virtue ethics - Principles of bioethics: autonomy, beneficence, non-maleficence, justice - Ethical decision-making models in bioethics

UNIT IV ETHICAL ISSUES IN BIOMEDICAL RESEARCH 10

Informed consent and research ethics - Ethical considerations in human subject's research - Animal experimentation ethics - Clinical trial ethics and regulation

UNIT V EMERGING ISSUES IN IPR & BIOETHICS 14

Biopiracy and indigenous rights - Gene editing technologies (e.g., CRISPR) and ethical implications - Access to essential medicines and global health equity - Ethical considerations in emerging biotechnologies

Total Hour: 60 Hours

Course Outcome:

CO-1: Summarize about the importance of IPR, Copyright and other Intellectual Property.

CO-2: Explain about Patent law, international agreements, WHO's patent details,

CO-3: List out timportance of Bioethics in Science

CO-4: Analyze about general ethical guidelines and its significance.

CO-5: Understand the institutional ethics committees and institutional review board.

CO-6: Understand animal experimentation ethics and clinical trial ethics and regulation.

CO-7: Illustrate on the steps involved in Gene editing technologies

CO-8: Adapt knowledge about emerging issues in IPR & Bioethics

Text and Reference Books:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
3. Tom L Beauchamp.Jerffry Khan,LeRoy Walters, Anna C Mastroanni.(2013) Contemporary issues in Bioethics.
4. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
5. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
6. Marianne Talbot (2012). Bioethics: An Introduction. Cambridge University Press; 1st edition.
7. Donald S. C., Tyler T. Ochoa, Shubha G., Mary L. (2011). Understanding Intellectual Property Law. LexisNexis; Second edition.
8. Mary A. B., David O., I. Glenn C., Mark A. H., (2018). Bioethics and Public Health Law, Fourth Edition. Aspen Publishing

24DBBT42 **CLINICAL RESEARCH**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE

To effectively understand the process involved in clinical research and its practical applications.

UNIT I INTRODUCTION TO CLINICAL RESEARCH 12

Origin - History – Introduction to Clinical Research –Types of Clinical Research – Treatment- Prevention- Diagnostic- Screening- Clinical Trials in India and the World- Application of Clinical Research.

UNIT II PRECLINICAL STUDIES 12

Introduction to preclinical pharmacology- Preclinical toxicity- Lab animals in clinical trials- Research question- Case report form- Informed consent- Data collection- Protocol writing- Research design- Sampling- Inclusion and exclusion criteria- Safety precautions during clinical trials.

UNIT III CLINICAL DEVELOPMENT 12

Preclinical drug testing-Clinical trials – Phases- New drug discovery process- new drug Application and Approval- Ethics in clinical trials- Unethical trials- Clinical trial on children- Fraud and Misconduct- Conflict of Interest in Clinical Trials.

UNIT IV REGULATIONS IN CLINICAL RESEARCH 12

ICMR guidelines – Ethics- ICH guidelines- Indian GCP- (CDCSO) guidelines- Clinical Trials Protocol- US FDA- European Medicine Agency- MHRA- Clinical Research Regulatory Submission and Approval.

UNIT V CLINICAL TRIAL DATA MANAGEMENT 12

Introduction- CRF Design- Electronic Data Capture- Data Validation- Discrepancy Management- Clinical Data Coding; SAE Reconciliation- Archiving Clinical Data.

Total Hour: 60 Hours

Course outcomes:

CO-1: Outline the history and types of clinical research.

CO-2: List out the regulations of Clinical Trials in India and the World

CO-3: Explain the prerequisites for clinical trials.

CO-4: Study the clinical development process.

CO-5: Navigate through the regulations in clinical research by different agencies around the world.

CO-6: Understand the importance of clinical trial data management and the process involved.

CO-7: List out the steps involved in Clinical Research Regulatory Submission and Approval.

CO-8: Elaborate on Clinical Data Coding in Clinical Management.

Text and Reference Books:

1. Shah, S. R., & Bhagat, P. (2020). Clinical Research: A Comprehensive Guide. Wiley-Blackwell.
2. Madhavan, S., & Rao, P. P. (2018). Clinical Research and Clinical Trials: A Step-by-Step Guide for Success. CRC Press
3. Harrington, S. W., & Stevens, M. (2021). Clinical Trials: A Practical Guide. Springer
4. Kumar, R., & Reddy, P. (2019). Regulations in Clinical Research: ICH, FDA, and GCP Guidelines. Elsevier Science
5. Iyer, S. V., & Rani, R. (2020). Preclinical and Clinical Drug Development: A Guide for Industry Professionals. CRC Pr
6. Stone, S. A., & Gupta, S. (2017). Essentials of Clinical Research. Cambridge University Press.
7. Law, M. R., & Brown, M. S. (2018). Introduction to Clinical Trials: An Introduction for Beginners. Wiley-Blackwell.
8. Liu, F., & Xiang, S. (2020). Clinical Research and Data Management. Elsevier.
9. Wood, L. K., & George, S. (2019). Clinical Trial Design and Analysis: A Comprehensive Guide. Springer.
10. Ognibene F. P, Gallin J. I. (2011) Principles and Practice of Clinical Research 2nd., ElsevierScience
11. Friedman L. M., Furberg C. D., DeMets D. L., (2015) Fundamentals of Clinical Trials, Springer; 5the.

24DBBT51 **NANOBIOTECHNOLOGY**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

The aim of this course is to provide knowledge about the basics, principles and applications of nanotechnology in the field of Biotechnology

UNIT I: INTRODUCTION TO NANOPARTICLES 11

History of Nanoscience - Definition – Quantum dots– Nanospheres– Nanorods– Nanofibers– Nanotubes – Properties of Nanoparticles (Physical and chemical). DNA–peptide–protein as nanomaterials.

UNIT II BIOSYNTHESIS OF NANOPARTICLES 12

Synthesis - Biological methods – Extra cellular and Intracellular synthesis - Bacteria, actinomycetes, algae, fungi and plants in synthesis of Nanoparticles. Optimization – pH, temperature, concentration.

UNIT III CHARACTERIZATION AND PRINCIPLES OF NANOPARTICLES 13

Plasmon resonance – UV Spectrophotometer – Dynamic light scattering – particle size analyser – Size Determination – SEM, TEM, STEM, AFM, Energy Dispersive Spectroscopy (EDS) - X-ray diffraction (XRD) – Fourier transform Infra-Red (FTIR) spectrophotometry, Surface analysis of Nanoparticles – Brunauer Emmett Teller (BET) surface area analysis.

UNIT IV BIOLOGICAL APPLICATIONS OF NANOMATERIALS 12

Application of Nanoparticles in Nanomedicine, Nanotechnology in Agriculture, Nanotechnology in Bioremediation, Nano sensor, Natural Nanoparticles – Clinoptilolite.

UNIT V BIOSAFETY 12

Particulate matters – Nanoparticulate - Exposure to Nanoparticles – Toxicity of nanoparticles - Health Impact - Occupational hazards, PPE.

Total: 60 Hours

COURSE OUTCOME:

CO-1: Define nanoparticles and differentiate their types based on their structure.

CO-2: Demonstrate the principles of biological materials as nanomaterial

CO-3: Elaborate a method for synthesis of Nanoparticles using biological methods.

CO-4: Illustrate on techniques used for characterization of nanoparticles.

CO-5: Gains knowledge on the application of Nanoparticles in medicine.

CO-6: Explain the application of Nanoparticles in the environment and other biological sciences

CO-7: Adapt the importance of biosafety, and occupational exposure of Nanoparticles.

CO-8: Understand the exposure hazard to Nanoparticles and risk assessment of Nanoparticles

Text and Reference Books:

1. Rao,C.N.R., The Chemistry of Nanomaterial: Synthesis, Properties and Applications. Vol I and III, Springer on line book. 2006.
2. Y uan, Z., & Zhang, X. (2018). Nanotechnology in Drug Delivery: Applications and Perspectives. Springer.
3. Roco, M. C., & Bainbridge, W. S. (2020). Nanotechnology: Societal Implications. Elsevier.
4. Sahoo, S. K., & Mahapatra, A. (2021). Nanobiotechnology: Principles and Applications. CRC Press.
5. Kumar, S., & Singh, R. (2020). Nanomaterials in Drug Delivery and Biomedical Applications. Wiley-Blackwell.
6. Sharma, R., & Mishra, V. (2017). Nanoparticles in Medicine: Their Role in Biomedicine and Healthcare. Elsevier.
7. Tiwari, A., & Ghosh, P. (2019). Nanotechnology in Medicine and Healthcare: Applications and Implications. Springer.
8. Patel, A., & Shah, M. (2021). Nanomaterials and Nanocomposites in Drug Delivery Systems. Elsevier Science.
9. Elder, A., & Wixted, J. (2020). Nanoparticles: Properties, Applications, and Safety Considerations. Wiley.
10. Jha, A. K., & Mishra, A. (2021). Biological Synthesis of Nanomaterials and Nanocomposites. Elsevier.
11. Muralidharan, V.S. and A. Subramanian, Nanoscience and technology. CRC Press, New Delhi.2009.

L	T	P	O	C
4	0	0	2	4

24DBBT52 **BIOCHEMISTRY - II**

COURSE OBJECTIVE:

To understand the major metabolic pathways, enzyme's importance, and their biological functions in living systems

UNIT I: CARBOHYDRATE METABOLISM AND BIOLOGICAL OXIDATION 14

Glycolysis, TCA cycle, HMP shunt, Cori cycle, Glycogenesis &Glycogenolysis, Gluconeogenesis, Electron transport chain, Oxidative Phosphorylation, ATP cycle, High energy compounds

UNIT 2 LIPID METABOLISM 12

Biosynthesis of fatty acids, membrane phospholipids, fatty acid synthase complex, & synthesis of unsaturated fatty acids. α, β-oxidation of fatty acids, role of carnitine in fatty acid transport, Cholesterol Biosynthesis.

UNIT 3 PROTEIN AND NUCLEIC ACID METABOLISM 12

Transamination, oxidative & Non-oxidative Deamination, Decarboxylation, Synthesis of Bioactive compounds from amino acid breakdown, Urea Cycle. Disorders of Amino acid metabolism- Phenylketonuria. Nucleotide metabolism- Synthesis and Breakdown of purines and Pyrimidines.

UNIT 4 INTRODUCTION TO ENZYMES 12

Enzymes – Introduction, Nomenclature, Classification, Properties, Turnover number, Mechanism of action, - factors affecting enzyme activity- pH, temperature, substrate and enzyme concentration, Enzyme Inhibition – Types of Inhibitors.

UNIT 5: ENZYME KINETICS AND MARKERS 10

Enzyme Kinetics- MM equation, LB plot, Allosteric enzymes, coenzymes, Iso enzymes and Enzymes Markers - their clinical importance.

Total: 60 Hours

COURSE OUTCOME:

CO-1: Understand the metabolism of carbohydrates, biological oxidation and its significance.

CO-2: Illustrate on ATP cycle and high-energy compounds.

CO-3: Importance of lipid metabolism and their biological functions

CO-4: Attain knowledge on protein metabolism

CO-5: Analyze the steps involved in nucleic acid metabolism

CO-6: Memory of the Enzyme structure, classification and mechanism of action

CO-7: Understand the factors affecting enzyme activity and enzyme inhibition.

CO-8: Elaborate on Enzyme kinetics and Markers and its importance

Text and Reference Books:

1. David L. Nelson and Michael M. Cox, (2020). "Lehninger"s Principles of Biochemistry", 8th Edition, W. H. Freeman Publisher,.
2. Berg, J. M., Tymoczko, J. L., Gatto, G. J., & Stryer, L. (2020). Biochemistry. 9th Edition. W.H. Freeman and Company.
3. Zhou, J., & Yan, Z. (2018). Biochemistry: A Short Course. Wiley.
4. Voet, D., Voet, J. G. (2017). Biochemistry. 4th Edition. Wiley.
5. Thomas M. Devlin, (2011). "Biochemistry with Clinical Correlations", 7th Edition, John Wiley and Sons,
6. Murray R.K., David, A, Bender, Kathleen M, Botham, Peter J. Kennelly, Victor W. Rodwell, P Anthony P, Weil D.K and Mayes P.A, (2009). "Harpers illustrated Biochemistry", 28th Edition, McGraw Hill publishers,
7. Deb A.C, (2014)." Textbook of Biochemistry", 10th Edition, New Central Book Agency, 2014.

24DBBT61 **BIOMEDICAL WASTE MANAGEMENT**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

This course aims to provide knowledge about source, types, handling, collection, and disposal and also ensure the proper and safe management of biomedical waste.

UNIT-I: INTRODUCTION TO BIOMEDICAL WASTE 9

Introduction, Definition, Scope and importance of biomedical waste. Categories of biomedical wastes (Human Anatomical Waste, Animal Waste, Microbiology & Biotechnology Waste, Waste sharps, Discarded Medicines and Cytotoxic drugs, Solid Waste, Liquid Waste, Incineration Ash and Chemical Waste).

UNIT-II: HEALTH IMPACTS BIOMEDICAL WASTE 9

Health impacts of biomedical wastes. Direct and Indirect hazards, Potential health hazards of BMW. Infectious agents in the biomedical wastes. Monitoring and controlling of cross infection (protective devices)

UNIT-III: HANDLING OF BIOMEDICAL WASTE 9

Biomedical waste - Handling rules, segregation, collection, transportation, disposal-color coding and type of container for disposal of biomedical wastes. Disposal technologies (sharp disposal pit, deep burial pit and secured land fill).

UNIT IV TREATMENT AND MANAGEMENT OF BIOMEDICAL WASTE 9

Treatment and management of biomedical wastes-on site - pretreatments, treatment-in-site and off-site (common treatment facilities). Liquid waste treatment by different technologies. Conventional treatment technologies (wet thermal and incineration)

UNIT V LEGISLATION POLICIES AND RULES OF BIOMEDICAL WASTES 9

Environment and legislation policies and rules for handling and management of biomedical wastes. CPCB guidelines. WHO guidelines for biomedical wastes.

Total: 45 Hours

COURSE OUTCOME:

CO–1: Understand of the basics, the Scope and importance of biomedical wastes

CO-2: Attain knowledge on different types of wastes and compositions.

CO–3: List about Potential health hazards of biomedical wastes.

CO–4: Summarize the principles and methods of disposal of biomedical wastes and secured landfill.

CO–5: Assess different technologies of the treatment and management of biomedical wastes

CO-6: Illustrate on the Conventional treatment technologies of biomedical wastes.

CO–7: Explain about the rules, policies and guidelines of biomedical wastes

CO-8: Understand the WHO guidelines for biomedical wastes

Text and Reference Books:

1. Gupta, S. K., & Ghosh, S. (2020). Biomedical Waste Management: A Comprehensive Guide. Springer.
2. Patel, M., & Kumar, M. (2021). Biomedical Waste Management: Principles and Practices. Springer.
3. BIS, Bureau of Indian Standards. (2019). Indian Standard for Biomedical Waste Management. IS 12472.
4. WHO. (2018). Safe Management of Wastes from Health-Care Activities. World Health Organization.
5. Central Pollution Control Board (CPCB). (2019). Guidelines for Management of Biomedical Waste. Government of India.
6. Chakraborty, A., & Das, M. (2019). Biomedical Waste Disposal and Treatment. Cambridge University Press.
7. Burris, V., & Burkett, D. (2017). Biomedical Waste: Management and Control. CRC Press.
8. Kumar, S., & Agarwal, S. (2017). Health Impacts of Biomedical Waste. Elsevier Publishing.
9. Behera P K, Sustainable Bio-Medical Waste Management (2 Vols.) Dominant Publishers and Distributors 1993
10. Glynn Henry J and Gary. W. Heinke, “Environmental Science and Engineering”, PreticeHall of India, 2004.

24DBBT62 **AGRICULTURAL BIOTECHNOLOGY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

To provide basic knowledge on the agronomy, agricultural practices, crop modification techniques and horticulture.

UNIT I AGRONOMY 9

Agronomy and its scope, water resources, soil-plant-water relationship, types of irrigation. Physical and chemical properties of soil, soil types and its importance in agriculture.

UNIT II AGRICULTURE PRACTICES 9

Soil preparation, Sowing, Manuring, Irrigation, Weeding, Harvesting, Storage. Agriculture practice with special reference to Rice, Groundnut and *Phaseolus mungo*. crop density and geometry, crop rotation.

UNIT III SEED SCIENCE 9

Seed and seed technology: characters of good quality seed – Phases of seed germination – different classes of seed- principles of seed production – post harvest handling of seed- threshing methods, seed drying- seed processing-seed certification –seed storage: factors affecting, pest and disease control, godown sanitation.

UNIT IV CROP MODIFICATION TECHNIQUES 9

Traditional Breeding, back cross, inbreeding, Hybrid breeding, Mutagenesis, Polyploidy, Protoplast fusion, Transgenics. Herbicide tolerance, Disease resistance, Drought tolerance, Temperature tolerance, Quality traits and Genetically Modified Plants. Golden Rice, Bt cotton, corn. Delayed fruit ripening.

UNIT V HORTICULTURE AND ORGANIC FARMING 9

Horticulture - branches, importance and scope. Nursery management and mechanization; micro propagation of horticultural crops. Hydroponics. Scope and importance of Organic farming. Biocompost, Vermicompost. Bionematicides, Biopesticides, Biofungicides. Panchakavya.

Total Hour: 45

COURSE OUTCOME:

CO-1: Understand the importance of soil and water in agriculture

CO-2: Explain about properties of different types of soil

CO-3: Gain knowledge on agricultural practice with special reference to rice, groundnut and *Phaseolus*.

CO-4: To learn about seed certification and production.

CO-5: illustrate about the seed storage, pest, disease control and godown sanitation.

CO-6: To learn crop modification techniques to improve crop traits

CO-7: Understand the basics of horticulture and Nursery management.

CO-8: Elaborate on the Organic farming composition of natural manure used for farming.

TEXT & REFERENCE BOOKS:

1. Biswas. T and Muherjee, (2017). Textbook of Soil Science, McGraw-Hill Education (2nd Edition)
2. Swaminathan, M. S. (2017). Agricultural Biotechnology: A Global Perspective. Springer.
3. Singh, B. D. (2020). Modern Techniques of Raising Field Crops. Oxford & IBH Publishing.
4. Rao, S. S., & Arumugam, T. (2021). Agronomy and Crop Science. Wiley-Blackwell.
5. Chawla, H. S. (2020). Biotechnology of Crop Improvement: Theories and Applications. CRC Press.
6. Sharma, M., & Gupta, A. (2020). Agricultural Biotechnology and Crop Improvement. Springer.
7. Pillai, K. R. (2020). Biotechnology and Sustainable Agriculture. Springer.
8. Pillai, K. R. (2020). Biotechnology and Sustainable Agriculture. Springer.
9. Chris Bird, (2014). The Fundamentals of Horticulture, Cambridge university Press.
10. David Castle, (2014). Peter W. B. Phillips, Stuart Smyth, Handbook on Agriculture, Biotechnology and Development, Edward Elgar Publication, 2014

24DBBT71 MANAGEMENT PRINCIPLES IN BIOTECHNOLOGY INDUSTRY

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVE:

This course aims to equip students with a deep understanding of management fundamentals and their application in the biotech sector. Through a structured curriculum, students will explore strategic management, industry analysis, and operational practices specific to biotechnology. By course completion, they will possess the skills needed to navigate the complexities of the biotech industry and contribute effectively to its growth and success.

UNIT I MANAGEMENT PRINCIPLES 12

Management Defined – Basic Principles and process of Management. The evolution of Management – various schools of thought. Planning – Planning as the first step in the process of Management cycle – Basic techniques of Planning – Basic factors involved in planning – key planning points – strategic considerations in planning. Overview of functions of management.

UNIT II MANAGEMENT ORGANIZATION 12

Strategic management, developing a strategic vision, mission management, establishing objectives, the concepts of strategic intent, crafting a strategy. The external environment – opportunities, threats, competitor analysis, the internal environment – resources, capabilities and core competencies. Organizational structure.

UNIT III BIOTECH BUSINESS 12

Historical development in biotechnology, industrial sectors and biotechnology industries. Conventional biotechnology, its origin and future prospects in biotech business, bioresource based biotech industry.

UNIT IV BIOTECHNOLOGY INDUSTRY 12

Biotechnology companies in Indian scenario, critical analysis of sectorial development in biotech. Industry for bioenergy, organic agriculture, GM plants and plant products, microbial consortium sourcing to agrobiotech, industry, drug delivery and targeting based on industrial resourcing.

UNIT V INDUSTRIAL MANAGEMENT 12

Introduction to various dosage forms, like tablets, capsules injections, oral liquids, topical and local applications like nasal drops, ear drops, eye drops, gargles lotions, liniments, creams etc. Layout of injectable units, sterile area, tabletting facilities, inventories, stores. GMP (Good Manufacturing Practices), Stability of the prepared products, concept of expiry date, role of FDA, ICH guidelines.

Total: 60 hours

COURSE OUTCOMES

CO 1: Proficiency in fundamental management principles for biotech project oversight.

CO-2: Explain on the Basic factors involved in planning.

CO 3: Strategic management skills tailored for the biotechnology industry.

CO 4: Understanding biotech's historical evolution and industry sectors.

CO 5: Critical analysis of the Indian biotech sector's development.

CO 6: Expertise in industrial management practices for biotech manufacturing.

CO-7: Elaborate on drug delivery and targeting based on industrial resourcing

CO-8: Role of FDA, ICH guidelines in Pharmaceutical products production.

TEXT & REFERENCE BOOKS:

1. Gupta, P. (2020*)*. Biotechnology Industry: An Introduction to Business Strategies and Operations. Springer.

2. Ramesh, G., & Sangeeta, S. (2022). Biotechnology and Management of Biotech Firms: A Global Perspective. Wiley-Blackwell.

3. Krishna, K. S., & Sharma, R. (2018). Strategic Management in the Biotechnology Industry. Springer.

4. Chatterjee, A., & Banerjee, A. (2020). Business and Financial Management in Biotechnology. Routledge.

5. Patel, A. J. (2021). Biotech Entrepreneurship and Management. Elsevier.

6. Kothari, S., & Verma, S. (2019). Managing Biotechnology Innovation: Challenges and Strategies. Oxford University Press.

7. Kumar, V., & Reddy, S. R. (2020). Biotechnology: Industrial Applications, Regulations, and Management. CRC Press.

8. Yadav, S. S., & Dubey, A. (2020). Biotechnology: Industry Perspectives and Business Models. Springer.

9. Sarkar, A., & Sengupta, P. (2021). Management Principles in the Biotechnology Industry. Wiley.



L	T	P	O	C
4	0	0	2	4

24DBBT72 BIOTECHNOLOGY AND HUMAN WELFARE

COURSE OBJECTIVE:

This course has been designed to introduce the various techniques in the modern era of biotechnology. It focuses on industrial biotechnology, agriculture and medical biotechnology and molecular techniques for forensic science.

UNIT I INDUSTRIAL BIOTECHNOLOGY 12

Industry: protein engineering; enzyme and polysaccharide synthesis, activity and secretion, alcohol and antibiotic formation.

UNIT II AGRICULTURAL BIOTECHNOLOGY 12

Agriculture: N2 fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; qualitative improvement of livestock.

UNIT III ENVIRONMENTAL BIOTECHNOLOGY 12

Environments: e.g. chlorinated and non-chlorinated organ pollutant degradation; degradation of hydrocarbons and agricultural wastes, stress management, development of biodegradable polymers such as PHB.

UNIT IV BIOTECHNOLOGY IN FORENSIC SCIENCE 12

Forensic science: e.g. solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing.

UNIT V BIOTECHNOLOGY IN MEDICINE 12

Health: e.g. development of non-toxic therapeutic agents, recombinant live vaccines, gene therapy, diagnostics, monoclonal in E.coli, human genome project.

Total Hour: 60

COURSE OUTCOME:

CO –1: Remember about the products of industrial biotechnology.

CO-2: Gain knowledge relevant to the applications of agricultural biotechnology.

CO–3: Show interaction between plants and microbes and the various techniques involved in environmental biotechnology.

CO–4: Outline about the degradation of hydrocarbons and agricultural wastes

CO–5: Understand about the molecular techniques of forensic science

CO-6: List out the various methods of DNA finger printing

CO–7: Demonstrate Students about non-toxic health care products,

CO-8: Illustrate on the human genome project and recombinant live vaccines

TEXT AND REFERENCE BOOKS

1. Glick, B. R., & Patten, C. L. (2017). Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press.
2. Singh, B. D., & Shekhawat, N. S. (2022). Biotechnology: Expanding Horizons. Kalyani Publishers.
3. Ratledge, C., & Kristiansen, B. (2019). Basic Biotechnology. Cambridge University Press.
4. Gupta, P. K. (2018). Elements of Biotechnology. Rastogi Publications.
5. Brown, T. A. (2020). Gene Cloning and DNA Analysis: An Introduction. Wiley-Blackwell.
6. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2019). Molecular Biology of the Cell. Garland Science.
7. Bhowmik, D., & Kumar, S. (2021). Biotechnology and Its Applications in Medicine and Agriculture. Springer.
8. Rastogi, S. C., & Pathak, N. (2022). Biotechnology and Human Welfare. CBS Publishers.
9. Dasgupta, P. N., & Mukherjee, S. (2020). Environmental Biotechnology: Biodegradation, Bioremediation, and Bioconversion. Springer.
10. Gola, D. (2019). Pharmaceutical Biotechnology: Fundamentals and Applications. Elsevier Publishing
11. Kumaresan V, N Arumugam, (2014). Environmental Biotechnology ,Saras publication,2014

24DBBT81 **DRUG DESIGNING**

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4	0	0	2	4

COURSE OBJECTIVE:

To equip students with a comprehensive understanding of drug discovery and development processes, focusing on molecular principles and computational methods, thereby preparing them for roles in pharmaceutical research and biotechnology industries.

UNIT I INTRODUCTION 14

History of drug design, Stages of drug discovery and development; Drug properties, likeness; Role of Bioinformatics and Chemo-informatics; Classification of Protein Structures – Primary, Secondary, Super-secondary, Tertiary and Quaternary; Active Sites; Allosteric Sites; Domains; Fold; Motifs. Structural databases- PDB, PDBSUM, SCOP, CATH; Chemical and Drug Molecule Databases – PubChem, Zinc and Drug Bank.

UNIT II PREPARATION OF PROTEIN STRUCTURE 11

Introduction to in silico and experimental protein structure determination methods; In silico Structure Prediction - Homology Modelling; Threading; Fold Recognition. Ab initio modelling; Model refinement and validation; Prediction of Binding site; Structure Visualization and Analysis tools.

UNIT III HIGH THROUGHPUT VIRTUAL SCREENING AND MOLECULAR DOCKING 12

Types of Virtual Screening methods; Structure Based Virtual Screening; Ligand Based Virtual Screening. Library design; Concept of pharmacophore mapping and pharmacophore-based Screening; Molecular Docking: Rigid and Flexible docking; Analysis of Protein-Ligand interactions. **UNIT IV QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIP 11**

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, Types of QSAR methods – 2D, 3D. Descriptors classification, Application of QSAR in molecular design.

UNIT V DRUG DISCOVERY 12

Drug Discovery and Development Drug Discovery Cycle, The Lead compound, Pharmacophore, Bioinformatics in drug discovery and development, chemical databases, ADME and Toxicity, Virtual Screening, Molecular Docking, Structure and Ligand Based Drug Designing, Case studies.

Total Hour: 60

COURSE OUTCOME

CO-1: Ability to classify protein structures and understand drug design principles.

CO-2: Explain on the different types of Structural and Drug Molecule Databases

CO-3: Proficiency in using visualization tools and modelling techniques for protein analysis.

CO-4: Understand the Concept of pharmacophore mapping and Screening

CO-5: Adeptness in conducting virtual screening and docking experiments.

CO-6: Understanding QSAR principles for predicting compound activity.

CO-7: Illustrate on the chemical databases and software used to analyze the ADME and Toxicity.

CO-8: Capability to design drug discovery strategies based on case studies

TEXT BOOK AND REFFERENCE BOOKS

1. Gong, J., & Chen, L. (2022). Computational Drug Discovery and Design: An AI and Machine Learning Perspective. *Springer*.
2. Keller, T. H., & Ecker, G. (2021). Pharmaceutical Bioinformatics: Drug Discovery, Design, and Development. Wiley-VCH.
3. Kitchen, D. B., & Decornez, H. (2020). Molecular Docking and Virtual Screening in Drug Discovery: Methods and Applications. Elsevier.
4. Hughes, J. D., & Lewis, R. A. (2019). Molecular Modeling and Drug Discovery: Computational Approaches in the Pharmaceutical Sciences. Taylor & Francis.
5. Barillari, C., & Taylor, R. D**.** (2018). Molecular Dynamics in Drug Discovery: Applications in Structure-Based Design. Wiley.
6. Capuzzi, S. J., & Muratov, E. N. (2020). Quantitative Structure-Activity Relationship (QSAR) Modeling in Drug Design and Toxicology. Springer.
7. Gohlke, H., & Klebe, G. (2022). Structure-Based Drug Design: From Protein Structure to New Therapeutic*s*. Wiley-VCH.
8. Kumar, A., & Zhang, K. Y. J. (2021). In Silico Methods for Drug Discovery and Development. Springer.
9. Schneider, G., & Tanrikulu, Y. (2018). Virtual Screening: An Alternative or Complement to High Throughput Screening? Wiley.

10. Durrant, J. D., & McCammon, J. A. (2019). Molecular Docking and Drug Discovery: From Theory to Applications. CRC Press.
11. Lesk, A.M. (2019). Introduction to Bioinformatics. Oxford University Press.

24DBBT82 ENTREPRENEURSHIP DEVELOPMENT IN BIOTECHNOLOGY

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4	0	0	2	4

COURSE OBJECTIVE:

To encourage and impart entrepreneurial intent and understanding of the scope of biotechnology.

UNIT I INNOVATION AND BIOENTREPRENEURSHIP 12

Introduction – Meaning- Importance and Scope- Entrepreneurship – Functions, types, and Stages of entrepreneurial process; Bioeconomy- Innovation as a strategy in biotech companies- Biosafety- Features of a successful entrepreneurship.

UNIT II MANAGEMENT PRINCIPLES 12

Types of Business Organizations- Demand Forecasting- Marketing– Segmentation- Targeting and Positioning, Need Identification: Maslow's Hierarchy- SWOT Analysis- Finance – Basics of Accounting, Financial statements- taxes-Break-even analysis. Feasibility study. Funding the venture – Angel Investors, Venture capitalists etc.,

UNIT III INTELLECTUAL PROPERTY 12

Introduction to IPR- Factors - patentability- Procedure for patent- registration- Types of Intellectual property – Trademarks- Copyrights- Trade secrets- Patents, etc.

UNIT IV ETHICS AND LEGAL IMPLICATIONS 12

Business ethics- Ethical implications of biological products – cloning- gene mutations-types- GMOs- Laws governing Biotechnological innovations - Consumer products.

UNIT V SCOPE AND CASE STUDY 12

Scope of Biotechnology –Applications of Biotechnology- Biosensors- Artificial Intelligence- 3D Bioprinting-Gene cloning- Gene Editing- Synthetic Biology- Stanford Biotechnology group- Can Science be a business- Lessons from Biotech – HBR.

Total Hour: 60

COURSE OUTCOMES:

CO-1: Understand the biotechnological start-up environment.

CO-2: Importance of Biosafety in the successful entrepreneurship.

CO-3: Study some basic marketing and financial management techniques.

CO-4: List out the different types of Business Organizations

CO-5: Acquire knowledge on the protection of intellectual property.

CO-6: Assess the legal and ethical impact of a biotechnological venture.

CO-7: Illustrate on the GMOs- Laws governing Biotechnological innovations

CO-8: Analyze the prospects for business in biotechnology using cases from Stanford and Harvard.

TEXT AND REFERENCE BOOKS:

1. Wang, T., & Tan, S. (2022). Biotech Startups: Navigating the Entrepreneurial Journey from Lab to Market. Springer.
2. Craig Shimasaki, ed. (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Elsevier Inc..
3. Garg, B., & Sharma, V. K. (2021). Entrepreneurship in Biotechnology: Innovation, IPR, and Commercialization. CRC Press.
4. Drucker, P. (2019). Innovation and Entrepreneurship: Practice and Principles. Harper Business.
5. Shimasaki, C. D. (2020). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Academic Press.
6. Mason, C., & Brown, R. (2021). Entrepreneurial Ecosystems and Growth-Oriented Startups. Routledge.
7. Jolly, V. K. (2018). Commercializing New Technologies: Getting from Mind to Market. Harvard Business Review Press.
8. Khan, M. A., & Shamsi, T. N. (2022). Intellectual Property Rights and Biotech Startups. Wiley.
9. World Intellectual Property Organization (WIPO). (2022). Patent Landscape Report: Biotechnology Innovation Trends.
10. Harvard Business Review (HBR). Biotech Case Studies on Entrepreneurship & Market Strategy (2019-2023).
11. S. N. Jogdand, (2007). Entrepreneurship and Business of Biotechnology, Himalaya Publishing.
12. Sarita D'Souza (2006). “Indian Patent Law: Legal and Business Implications” by AjitParulekar, Macmillan India publication, 2006

SKILL ENHANCEMENT COURSES

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2	0	0	1	2

24SSKU11 **SOFT SKILLS I**

COURSE OBJECTIVES:

CO1: To learn and apply basic etiquette for personal and professionalinteractions.

CO2: To develop effective stress management techniques for maintaining mental and emotionalwell-being.

CO3: To enhance self-awareness for personal growth and informed decision-making.

CO4: To gain an overview of essential 21st-century skills necessary for success in a rapidlychanging world.

CO5: To foster creativity and critical thinking skills for innovative problem-solving andadaptability.

Credits Hours

UNIT I INTRODUCTION TO SOFT SKILLS 6

- Soft Skills vs Hard Skills
- 15 important Soft Skills
- Communication Skills, Time Management, Leadership Skills

UUNIT II - OVERVIEW OF 21ST CENTURY SKILLS. 6

- Lateral Thinking – Left Brain/Right Brain Functionality
- Problem solving skills

UNIT III - SELF AWARENESS 6

- Human Values
- Mindfulness
- SWOT Analysis
- PDCA Approach

UNIT IV - CREATIVITY/CRITICAL THINKING 6

- Six Thinking Traits
- Creative writing exercises
- Open mindedness

UNIT V - PERSONAL HYGIENE AND STRESS MANAGEMENT 6

- Basic Etiquettes
- Health and Personal Grooming
- Stress-meaning and nature, Eustress, Distress
- Stress management strategies

Total: 30 Hours

Course Outcomes:

At the end of this course, the students would have learnt to

COC1 demonstrate basic etiquette in various personal and professional settings.

COC2 effectively manage stress using learned techniques.

COC3 show increased self-awareness and make informed decisions.

COC4 understand and articulate key 21st-century skills.

COC5 apply creativity and critical thinking to solve problems innovatively.

References:

- L. Swan (2009) Creative Writing, published by Emerald.
- K. Isabelle (2013) Creative Writing, published by Fairfield.
- L. David (2011) The Practice of Writing, published by Vintage.

L	T	P	O	C
2	0	0	1	2

24SSKU21 **SOFT SKILLS II**

COURSE OBJECTIVE:

CO1: To develop strategies to enhance teamwork and collaboration in professional settings.

CO2: To cultivate a positive attitude and mindset to foster constructive relationships and productivity.

CO3: To develop leadership, decision-making and team bonding skills

Credit Hours

UNIT I - PROFESSIONAL BEHAVIOUR 6

- Team Building – Team Bonding
- Inter-Personal Relationship– Intra-Personal Relationship

UNIT II - PERSONALITY DEVELOPMENT 6

- Types of Personality
- Self-Confidence - Confidence Building
- Attitude (Positive/Negative)

UNIT III - TELEPHONE ETIQUETTE 6

- Basics of telephone etiquette
- Giving clear and concise information
- Tone & rate of speech
- Intonations & its Importance
- Whatsapp Communications

UNIT IV - DECISION MAKING 6

- Types of Decisions – planned-unplanned, individual-group, major-minor
- Types of Leadership styles – Autocratic, democratic, lesse-faire, participative, bureaucratic.

UNIT V- PROFESSIONAL ETIQUETTE 6

- Respect – Salutations

- Official Behaviour

Total: 30 Hours

Course Outcome:

At the end of this course, the students would have learnt to

CO1	understand the principles of effective team building and apply strategies to foster team bonding and cohesion in professional settings.
CO2	become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills.
CO3	practice techniques for effective communication in telephone conversations.
CO4	evaluate decision-making processes and their implications in professional settings.
CO5	exhibit professional conduct and demeanor in various professional situations.

References:

- Language Service, University at Oberta de Catalunya
- Taylor (2005) Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd.
- Tiko, Champa & Jaya Sasikumar (1979), Writing with a purpose, OUP New Delhi.
- Alex, Dr. K. (2014). Soft Skills (1st edition) S Chand & Company.
- Nelson-Jones, R. (1992). Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.

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2	0	0	1	2

24SSKU31 **SOFT SKILLS –III**

COURSE OBJECTIVES:

- To hone the creative and critical faculties of learners.
- To enhance descriptive and narrative skills through short story creation.
- To acquire professional reports and review writing skills for various mediums.

UNIT I 06

Meaning and Significance of Creative Writing,

Refining Vocabulary, Word order, Developing Hints

UNIT II WRITING SKILLS 06

- Genres of Writing
- Descriptive Passages, Short Stories, Narration of incidents

UNIT III ACADEMIC WRITING 06

- Report Writing, Writing of book reviews and film reviews

UNIT IV WRITING FOR MEDIA 06

- Writing for TV, Radio and Magazine, Freelance Writing, Preparation of Web Content

UNIT V ADVERTISEMENT WRITING 06

- Types of advertising and advertising media, Writing techniques
- Ineffective advertisement, Code of ethics for advertisement
- Advertising and marketing.

Total:30 Hours

Course Outcomes:

At the end of this course, the students would have learnt to:

CO1	craft rhymes, free verse, jokes, and articles proficiently
CO2	write descriptive passages and short stories to exhibit their creative writing prowess.
CO3	write informative reviews and structured reports for diverse media.
CO4	create content for television, radio, magazines, and website and freelancing platforms.

CO5	create compelling content for various platforms, adhering to ethical standards in advertising and marketing principles.

References:

- Creative Writing Log by Swan, published by Emerald in 2009.
- Creative Writing by Isabelle Krishnan, published by Fairfield in 2013.
- The Practice of Writing by David Lodge, published by Vintage in

L	T	P	O	C
1	0	2	1	2

24SBBT41 **Industry Oriented Employability Skills (Career Skills)**

Course Objectives

The course enhances students proficiency in scientific communication, technical writing, data presentation, and familiarizes them with GLP, biosafety practices, industrial documentation, and essential laboratory instrumentation. It builds strong foundational skills in biostatistics, data interpretation, and basic bioinformatics tools relevant to life science research. The course also introduces key industry-specific technical skills and regulatory frameworks while equipping students with essential career competencies for the life science sector.

UNIT I – PROFESSIONAL & SCIENTIFIC COMMUNICATION 6

Scientific writing: lab reports, abstracts, SOPs ,Technical emails, memo writing, meeting documentation, Preparing and delivering scientific presentations, Data presentation (tables, graphs, charts), Scientific literature search (PubMed, Scopus, Web of Science)

UNIT II – LABORATORY & INDUSTRIAL BEST PRACTICES 6

Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP), Data Integrity: ALCOA+ principles, Biosafety: BSL 1–3, PPE, waste handling, Calibration & validation of laboratory equipment, Industrial documentation: BMR, BPR, logbooks. Overview of Instruments used in a Biotechnology laboratory.

UNIT III – DATA SKILLS: BIOSTATISTICS, DATA SKILLS & BIOINFORMTICS 6

Biostatistics - Basic statistics: mean, median, mode, SD, variance, Hypothesis testing: t-test, chi-square, ANOVA, Dose-response curves, IC_{50}. Bioinformatics - (Basic) -DNA/protein databases: NCBI, UniProt, BLAST, Sequence alignment & phylogeny basics

UNIT IV – INDUSTRY – SPECIFIC TECHNICAL SKILLS 6

Biopharma & Bioprocessing, Upstream & downstream processing overview, Sterility, media preparation, Fermentation basics. Pharmaceutical Biotechnology, Environmental monitoring (EM). Diagnostic & POCT Skills, rapid diagnostic workflows, Sample processing & handling. **Environmental/Food/Industrial Biotechnology -** HACCP basics, Food safety, Bioremediation & effluent microbiology, Water quality testing basics

UNIT V– REGULATORY AFFAIRS QUALITY SYSTEMS & CAREER SKILLS 6

Regulatory Systems - ISO standards: ISO 9001, 17025, 15189, 13485, CDSCO, FDA, ICMR, WHO guidelines, Product development pathway. **Employability Essentials -**Resume & cover letter for life

science roles, Mock interview (technical + HR), Aptitude skills (basics), Teamwork, time management, workplace ethics.

Total: 30 Hours

Course Outcomes:

At the end of this course, the students would have learnt to

CO1	Demonstrate proficiency in professional and scientific communication, including technical writing, data presentation, and scientific literature search.
CO2	Apply Good Laboratory Practices, biosafety principles, and industrial documentation standards in laboratory and industrial settings.
CO3	Utilize biostatistical tools, perform hypothesis testing, and interpret basic bioinformatics analyses such as BLAST and sequence alignment.
CO4	Acquire foundational technical skills relevant to biopharma, diagnostics, pharmaceutical Biotechnology, and environmental/industrial biotechnology.
CO5	Understand regulatory frameworks, implement quality systems, and develop essential career readiness skills for life science industries.

References:

1. J.G. Colle, A.G. Fraser, B.P. Marmion and A. Simmons (2023), *Mackie & McCartney Practical Medical Microbiology*, 14th Edition, Elsevier Health Sciences, India.
2. Cappuccino, J.G. and Sherman, N. (2022), *Microbiology: A Laboratory Manual*, 12th Edition, Pearson Education.
3. Gupta, P.K. (2020), *Elements of Biostatistics*, 5th Edition, Sultan Chand & Sons.
4. Mount, D.W. (2018), *Bioinformatics: Sequence and Genome Analysis*, 2nd Edition, Cold Spring Harbor Laboratory Press.
5. Sandle, T. (2017), *Pharmaceutical Microbiology: Essentials for Quality Assurance and Quality Control*, 2nd Edition, Elsevier.
6. Stanbury, P.F., Whitaker, A. and Hall, S. (2016), *Principles of Fermentation Technology*, 3rd Edition, Butterworth-Heinemann.
7. WHO (2020), *Laboratory Biosafety Manual*, 4th Edition, World Health Organization.
8. ISO (2023), *Quality Management Standards: ISO 9001, 17025, 15189 & 13485 Guidelines*, International Organization for Standardization.

24EMBE51 **CYBER SECURITY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE

- To provide foundational knowledge of cyberspace, web technologies, and the evolving landscape of cyber security and its challenges.
- To familiarize students with the types of cyber crimes, legal frameworks including the IT Act 2000, and organizational measures for mitigating cyber threats.
- To equip students with practical understanding of securing digital devices, social media usage, e-commerce platforms, and digital payment systems.

UNIT I INTRODUCTION TO CYBER SECURITY 9

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security

UNIT II CYBER CRIMEAND CYBER LAW 9

Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.

UNIT III SOCIAL MEDIA OVERVIEW AND SECURITY 9

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

UNIT IV E – COMMERCE AND DIGITAL PAYMENTS 9

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), eWallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007

UNIT V DIGITAL DEVICES SECURITY, TOOLS AND TECHNOLOGIES FOR CYBER SECURITY 9

End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

COURSE OUTCOME

CO1: To explain the architecture of cyberspace, web technologies, and internet infrastructure with respect to cyber security.

CO2: To Identify various cyber crimes and evaluate legal remedies under the IT Act 2000 and associated cyber laws in India.

CO3: To Analyze the structure and impact of social media platforms and assess the security risks and legal implications of online content.

CO4: To understand e-commerce and digital payment mechanisms, including associated frauds, security practices, and relevant legal provisions.

CO5: To Apply cyber security tools and best practices for securing personal and organizational digital devices, networks, and systems.

TEXTBOOK/ REFERENCES

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition2010.

2. Cyber Security Understanding Cyber Crimes, Computer Forensics and LegalPerspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (FirstEdition, 2011)

3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities byHenry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13thNovember, 2001)

4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.

5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, DominantPublishers.

6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition,Wiley India Pvt. Ltd.7. Fundamentals of Network Security by E. Maiwald, McGraw Hill