



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(Deemed to be University Encl. no.3 of the UGC Act, 1956)

PALLAVARAM - CHENNAI

ACCREDITED BY NAAC WITH 'A' GRADE

*Marching Beyond 30 Years Successfully*

INSTITUTION WITH UGC 12B STATUS

## **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

<b>M1</b>	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.
<b>M2</b>	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.
<b>M3</b>	To provide hands-on training and technical skills to transform students into technocrats and facilitate research and higher education in the fields of biotechnology.
<b>M4</b>	To create opportunities and a supporting infrastructure for students through laboratory courses, projects, dissertations, and possible entrepreneurial ventures in biotechnology to achieve their aspirations.
<b>M5</b>	To pursue and promote cutting-edge research in selected fields of biotechnology.

### PROGRAMME EDUCATIONAL OUTCOMES (PEO)

<b>PEO1</b>	The graduates of biotechnology will be able to attain in-depth knowledge of the basic and application-oriented subjects of biotechnology and allied fields.
<b>PEO2</b>	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.
<b>PEO3</b>	The biotechnology graduates are prepared to design, evaluate, conduct, and interpret experiments and data in order to develop processes/products within realistic limits.
<b>PEO4</b>	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.
<b>PEO5</b>	The biotechnology graduates are trained to demonstrate creativity, develop innovative ideas and to work in teams to accomplish a common goal.

### PROGRAMME OUTCOMES (PO)

<b>PO1</b>	<b>Scientific knowledge:</b> 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.
<b>PO2</b>	<b>Problem analysis:</b> Graduates will be able to analyse, solve and troubleshoot problems in implementation of biochemistry/biotechnology/ microbiological protocols.
<b>PO3</b>	<b>Design/development of solutions:</b> Graduates will develop creative thinking and cooperate with each other to solve problems in the field of biochemistry/ biotechnology/ bioinformatics/ microbiology.
<b>PO4</b>	<b>Conduct investigations of complex problems:</b> 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.

<b>PO5</b>	<b>Modern tool usage and communication:</b> 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.
<b>PO6</b>	<b>Environment sustainability and Ethics:</b> 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.
<b>PO7</b>	<b>Lifelong learning:</b> Graduates will carry on to learn and adapt in a world of constantly evolving technology.

### **PROGRAMME SPECIFIC OUTCOMES (PSO)**

<b>PSO1</b>	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.
<b>PSO2</b>	A Demonstrate the application of Biotechnological processes in industries that are of social and commercial importance.
<b>PSO3</b>	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**

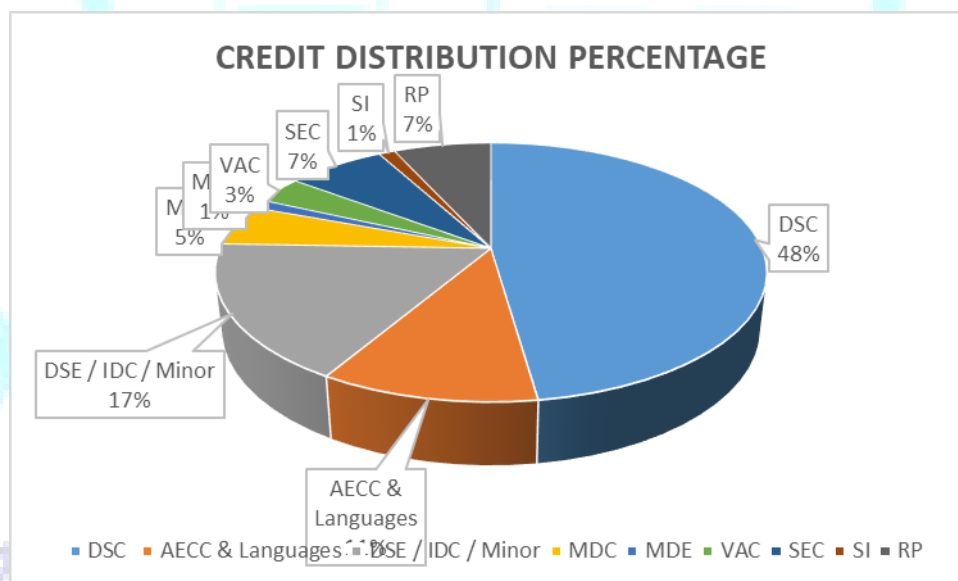
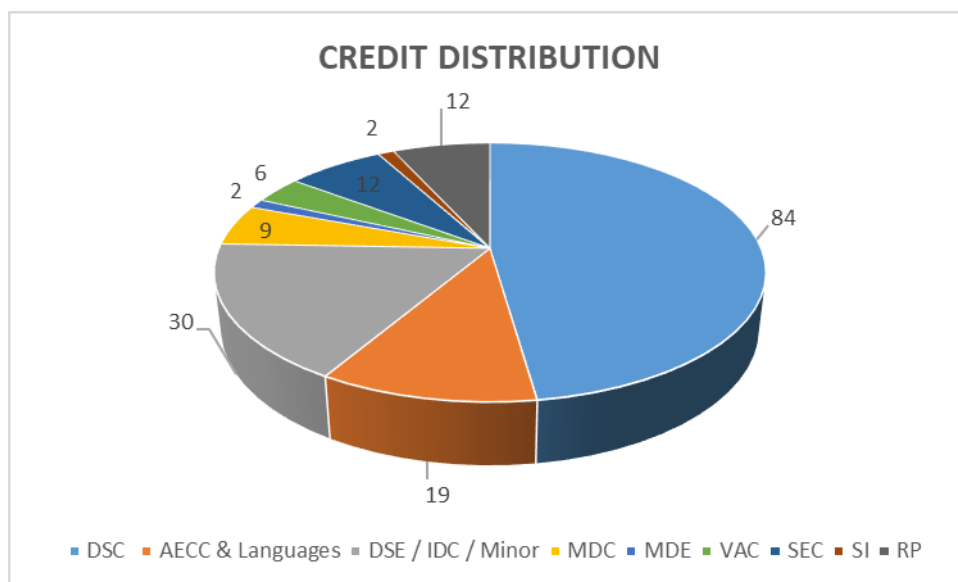
<b>S. No</b>	<b>Name &amp; Designation</b>	<b>Address</b>	<b>Role</b>
1.	Dr. K. Ashok Kumar	Associate Professor & HOD, Department of Biotechnology	Internal Member
2.	Dr. Rajeswary Hari	Professor & Head, Department of Biotechnology, Dr MGR Educational & Research Institute University, Maduravoyal, Chennai - 600 117	Academic Expert (External Member)
3.	Dr. P. Balashanmugam	Director, AviGen Biotech Pvt Ltd. No. 7, 1 <sup>st</sup> floor, 1 <sup>st</sup> 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**

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



## ABBREVIATIONS

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

## CURRICULUM STURCTURE

**B.Sc., Biotechnology Three Years**

/

**B.Sc., (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
<b>LANG 1</b>	24LTAM11/	Tamil I /								
	24LHIN11/	Hindi I/	2	0	0	1	2	40	60	100
	24LFRE11	French I								
<b>ENG 1</b>	24LENG11	English I	2	0	0	1	2	40	60	100
<b>DSC 1</b>	24CBBT11	Cell Biology and Genetics	3	0	0	2	3	40	60	100
<b>DSC 2</b>	24CBBT12	Molecular Biology	4	0	0	2	4	40	60	100
<b>MDC 1</b>	24MBBT11	Nutrition and Health	3	0	0	2	3	40	60	100
<b>DSE 1/ IDC 1 / Minor 1</b>	24DBBT1-	Discipline Specific Elective – I	4	0	0	2	4	40	60	100
<b>DSC 1 (Lab)</b>	24PBBT11	Practical I Cell Biology, Genetics	0	0	2	1	1	40	60	100
<b>VAC 1</b>	24DVAC11	Universal Human Values	1	0	0	1	1	-	100	100
<b>SEC 1</b>	24SSKU11	Soft Skills I	2	0	0	1	2	40	60	100
<b>SEC 2</b>		Orientation programme / Industrial Visit	-	-	-	-	-	-	-	-
			<b>21</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>22</b>	<b>-</b>	<b>-</b>	<b>-</b>

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
<b>LANG 2</b>	24LTAM21/	Tamil II /								
	24LHIN21/	Hindi II /	2	0	0	1	2	40	60	100
	24LFRE21	French II								
<b>ENG 2</b>	24LENG21	English II	2	0	0	1	2	40	60	100
<b>DSC 3</b>	24CBBT21	Fundamentals of Microbiology	3	0	0	2	3	40	60	100
<b>DSC 4</b>	24CBBT22	Biochemistry-I	3	0	0	2	3	40	60	100
<b>MDC 2</b>	24MBBT21	Phytochemistry and Herbal Medicine	3	0	0	2	3	40	60	100
<b>DSE 2 / IDC 2 / Minor 2</b>	24DBBT2-	Discipline Specific Elective – II	4	0	0	2	4	40	60	100
<b>DSC 3 (Lab)</b>	24PBBT21	Practical II - Microbiology	0	0	2	1	1	40	60	100
<b>DSC 4 (Lab)</b>	24PBBT22	Practical III - Biochemistry	0	0	2	1	1	40	60	100
<b>VAC 2</b>	24DVAC21	Communication Skills	2	0	0	1	2	40	60	100
<b>SEC 3</b>	24SSKU21	Soft Skills II	2	0	0	1	2	40	60	100
			<b>21</b>	<b>-</b>	<b>4</b>	<b>-</b>	<b>23</b>	<b>-</b>	<b>-</b>	<b>-</b>

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**SEMESTER 3**

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

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### SEMESTER 4

Category	Code	Course	L	T	P	O	C	CIA	SEE	Total
LANG 4	24LTAM41/	Tamil IV /								
	24LHIN41/	Hindi IV /	2	0	0	1	2	40	60	100
	24LFRE41	French IV								
ENG 4	24LENG41	English IV	2	0	0	1	2	40	60	100
AECC 1	24EVS031	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	-	-	-	-	-	-	-	-
			<b>18</b>	<b>-</b>	<b>8</b>	<b>-</b>	<b>22</b>	<b>-</b>	<b>-</b>	<b>-</b>

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### 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	3	0	0	2	3	40	60	100
DSC 11	24CBBT53	Human Physiology and Developmental Biology	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
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	-	-	-	-	-	-	-	-
			<b>18</b>	<b>-</b>	<b>6</b>	<b>-</b>	<b>21</b>	<b>-</b>	<b>-</b>	<b>-</b>

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### 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)	24PBTT61	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	-	-	-	-	-	-	-	-
			<b>18</b>	-	<b>6</b>	-	<b>21</b>	-	-	-

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

**CIA - Continuous Internal Assessment**

**SEE - Semester End Examination**

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

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

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### 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 (Lab)	24PBBT42	Practical VII – Animal Biotechnology	0	0	2	1	1
DSC 9	24CBBT51	Bio fermentation and Downstream Processing	3	0	0	2	3

<b>DSC 10</b>	24CBBT52	Genetic Engineering	3	0	0	2	3
<b>DSC 11</b>	24CBBT53	Human Physiology and Developmental Biology	4	0	0	2	4
<b>DSC 9 (Lab)</b>	24PBBT51	Practical VIII - Biofermentation	0	0	2	1	1
<b>DSC 10 (Lab)</b>	24PBBT52	Practical IX – Genetic Engineering	0	0	2	1	1
<b>DSC 12</b>	24CBBT61	Bioinformatics	3	0	0	2	3
<b>DSC 13</b>	24CBBT62	Stem Cell Biology	4	0	0	2	4
<b>DSC 14</b>	24CBBT63	Microbial Biotechnology	4	0	0	2	4
<b>DSC 15</b>	24CBBT64	Medical Coding and Clinical Research	4	0	0	2	4
<b>DSC 12 (Lab)</b>	24PBBT62	Practical X - Bioinformatics	0	0	2	1	1
<b>DSC 16</b>	24CBBT71	Pharmaceutical Biotechnology	3	0	0	2	3
<b>DSC 17</b>	24CBBT72	Omics Technology	3	0	0	2	3
<b>DSC 18</b>	24CBBT73	Tissue Engineering	4	0	0	2	4
<b>DSC 16 (Lab)</b>	24PBBT71	Practical XI - Pharmaceutical Biotechnology	0	0	2	1	1
<b>DSC 19</b>	24CBBT81	Food Biotechnology	3	0	0	2	3
<b>DSC 20</b>	24CBBT82	Marine Biotechnology	3	0	0	2	3
<b>DSC 21</b>	24CBBT83	Research Methodology	4	0	0	2	4
<b>DSC 19 (Lab)</b>	24PBBT81	Practical XII – Food Biotechnology	0	0	2	1	1
<b>DSC 20 (Lab)</b>	24PBBT82	Practical XIII – Marine Biotechnology	0	0	2	1	1

## 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	Human Physiology and Developmental Biology	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	Biodiversity and Ecology	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/	Tamil I / Hindi I/ French I	2	0	0	1	2
	24LHIN11/						
	24LFRE11						

<b>ENG 1</b>	24LENG11	English I	2	0	0	1	2
<b>LANG 2</b>	24LTAM21/ 24LHIN21/ 24LFRE21	Tamil II / Hindi II / French II	2	0	0	1	2
<b>ENG 2</b>	24LENG21	English II	2	0	0	1	2
<b>LANG 3</b>	24LTAM31/ 24LHIN31/ 24LFRE31	Tamil III / Hindi III / French III	2	0	0	1	2
<b>ENG 3</b>	24LENG31	English III	2	0	0	1	2
<b>LANG 4</b>	24LTAM41/2 4LHIN41/ 24LFRE41	Tamil IV / Hindi IV/ French IV	2	0	0	1	2
<b>ENG 4</b>	24LENG41	English IV	2	0	0	1	2
<b>AECC 1</b>	24EVS031	Environmental Studies	3	0	0	2	3

### MULTIDISCIPLINARY COURSES

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

### MULTIDISCIPLINARY ELECTIVES

<b>Category</b>	<b>Code</b>	<b>Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>O</b>	<b>C</b>
<b>MDE 1</b>		Indian Knowledge System	1	1	0	1	2

### 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

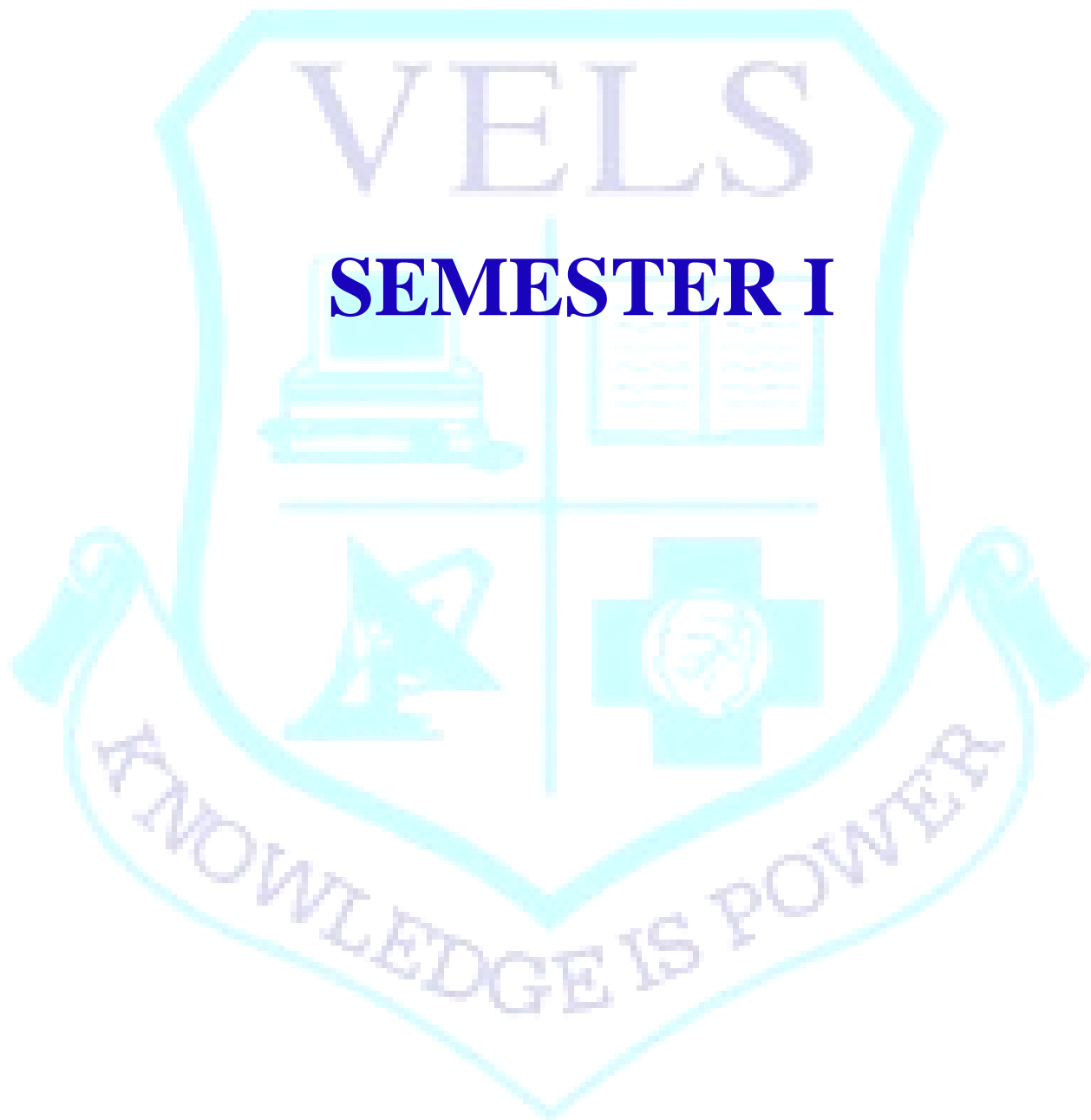
<b>SEC 10</b>		On Job Training / Apprenticeship / Startup	-	-	-	-	-
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### SUMMER INTERNSHIP

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

### RESEARCH PROJECT

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



**24LTAM11 மொழிவரலாறு - சங்க இலக்கியம் - அற இலக்கியம் - மொழித்திறன்**

பருவம்-1, தமிழ்மொழிப்பாடம்-1, பகுதி-1, தகுதிப்புள்ளி:

L	T	P	O	C
2	0	0	1	2

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  
हिन्दी)

वर्ष I – सत्र I (गद्य, पत्र लेखन & व्यावहारिक

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 Sanskritayayan.

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 + फॉन्ट 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.

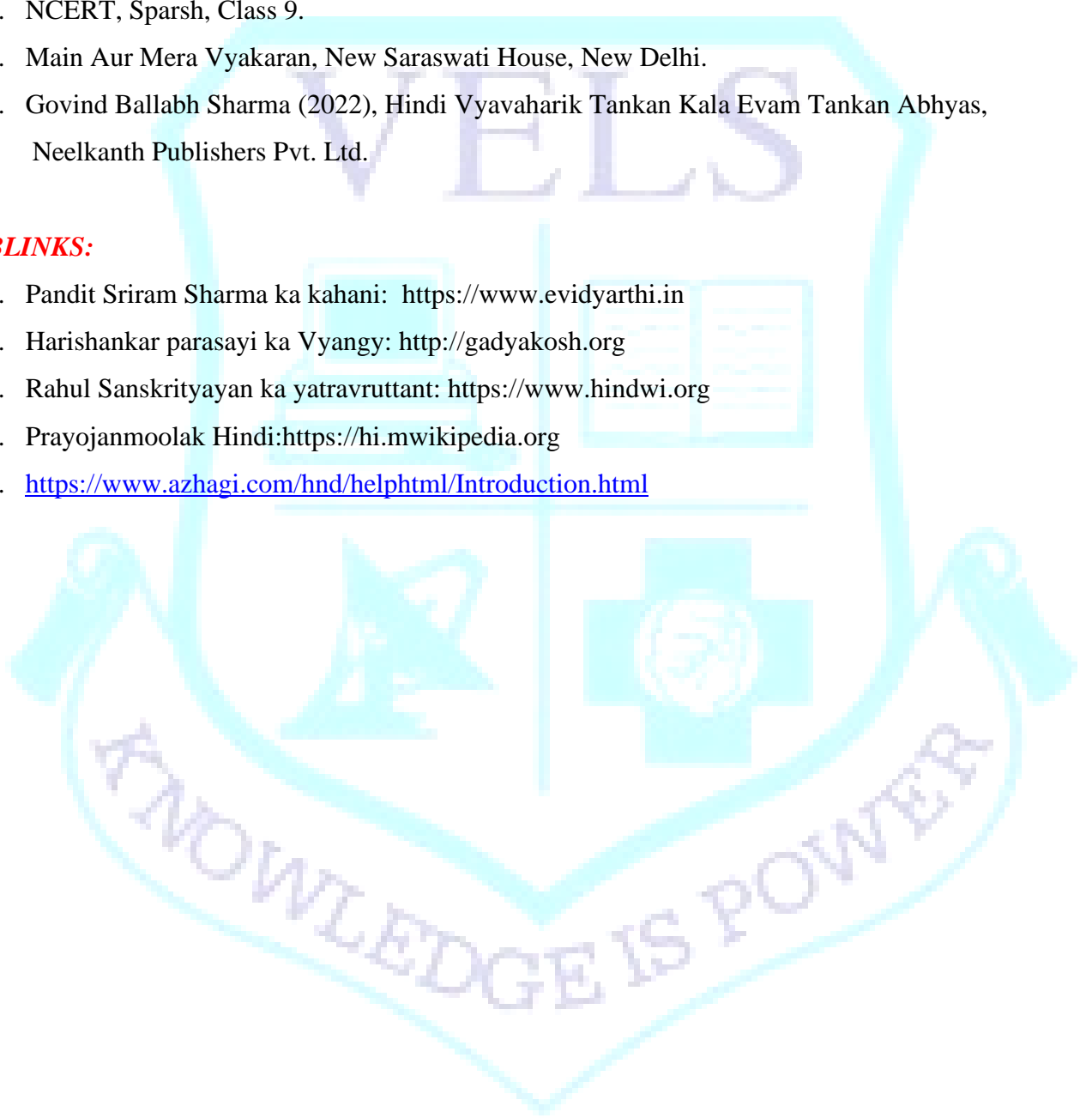
2. Sharad Joshi, Yatha Sambhav (2014), Bharatiya Gyanpeet.
3. Rahul Sanskritayan, Ghumakkad Shastra (1949), Rajkamal Prakashan.

**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 Tanka Kala Evam Tanka 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 Sanskritayan ka yatravruttant: <https://www.hindwi.org>
4. Prayojanmoolak Hindi:<https://hi.m.wikipedia.org>
5. <https://www.azhagi.com/hnd/helphtml/Introduction.html>



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



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.

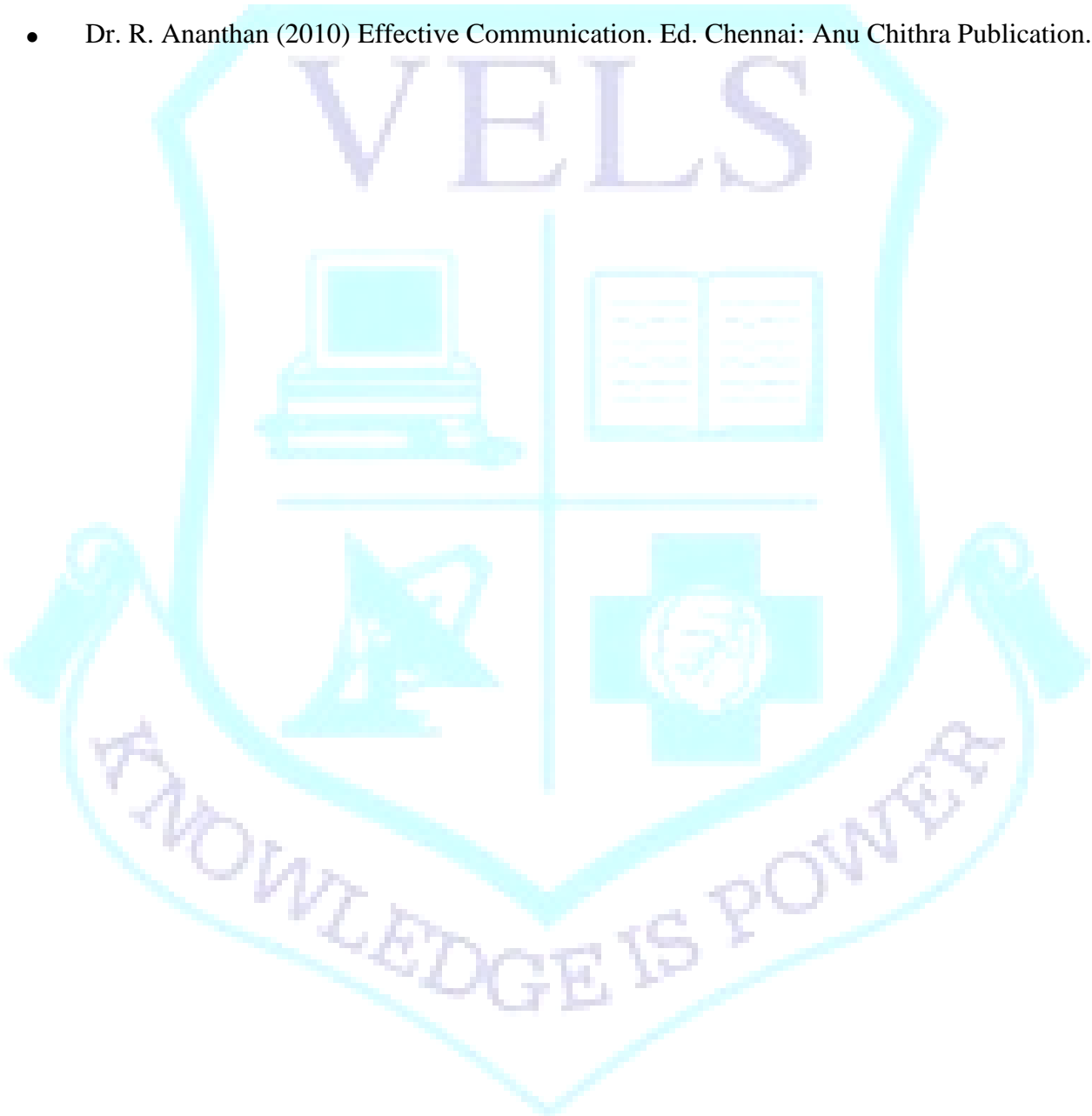
**Total: 30 hours****Course Outcomes:**

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

<b>CO1</b>	understand the characteristic features of the language used in the text.
<b>CO2</b>	strengthen their knowledge of basic grammar
<b>CO3</b>	improve narrative skills after studying diverse prose and play.
<b>CO4</b>	understand to classify parts of speech and articles.
<b>CO5</b>	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. 4<sup>th</sup> 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, 8<sup>th</sup> edition, John Wiley and Sons.
10. T. Robert, (2010) Principles of Genetics, 7th edition, Tata McGraw Hill publishing.

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. Freifelder, (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. 11<sup>th</sup> edition. Thompson Wadsworth.
2. Mc Guire Michelle, A. Kathy, (2013) Nutritional Sciences- From Fundamentals to Food. 2<sup>nd</sup> 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 – 2<sup>nd</sup> edition, Blackwell Publications

## 24PBBT11 PRACTICAL I: CELL BIOLOGY AND GENETICS

L	T	P	O	C
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### 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.

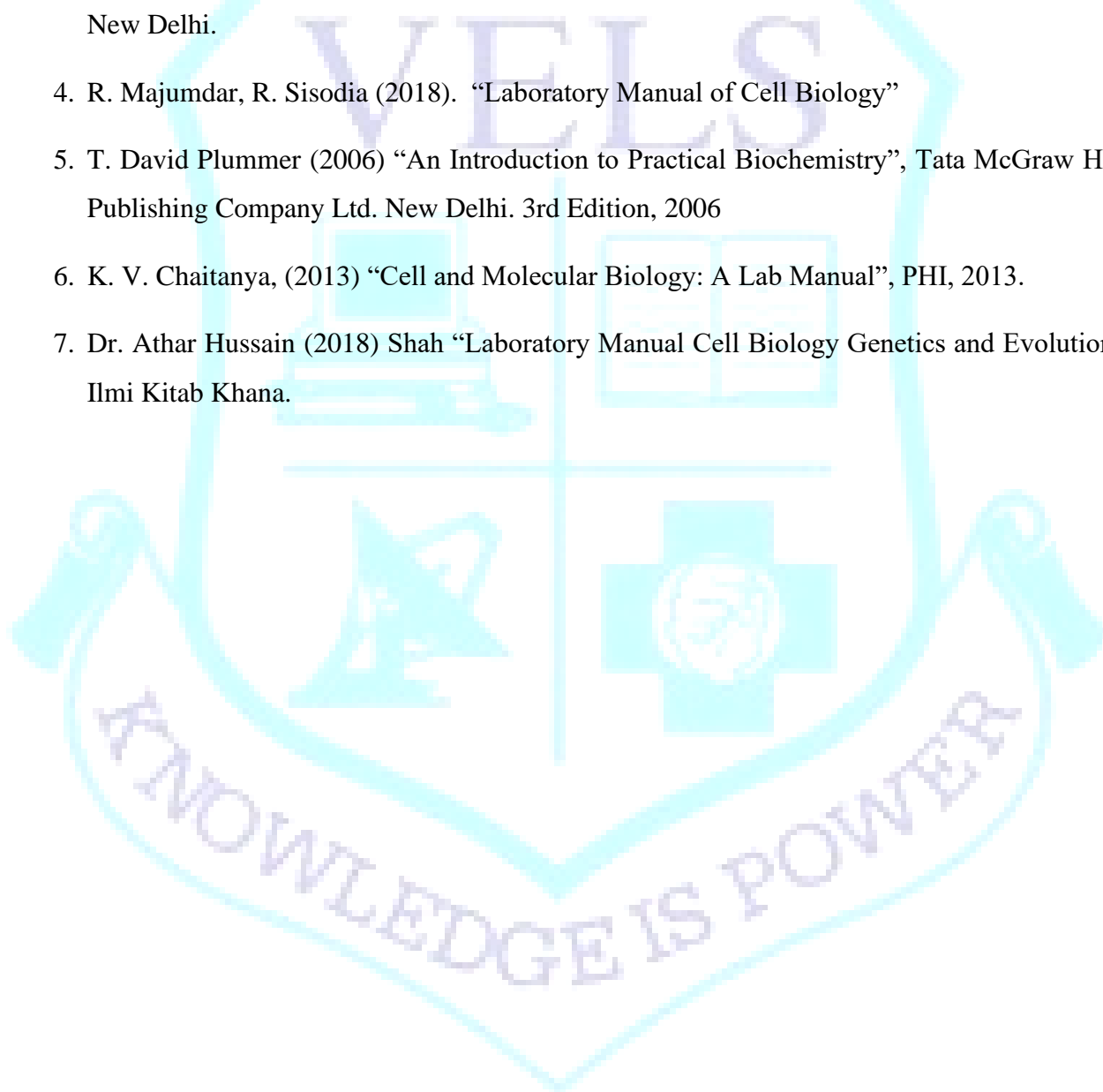
**CO-3:** Analyzing plant, animal and microbial cell structures using different staining methods

**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.

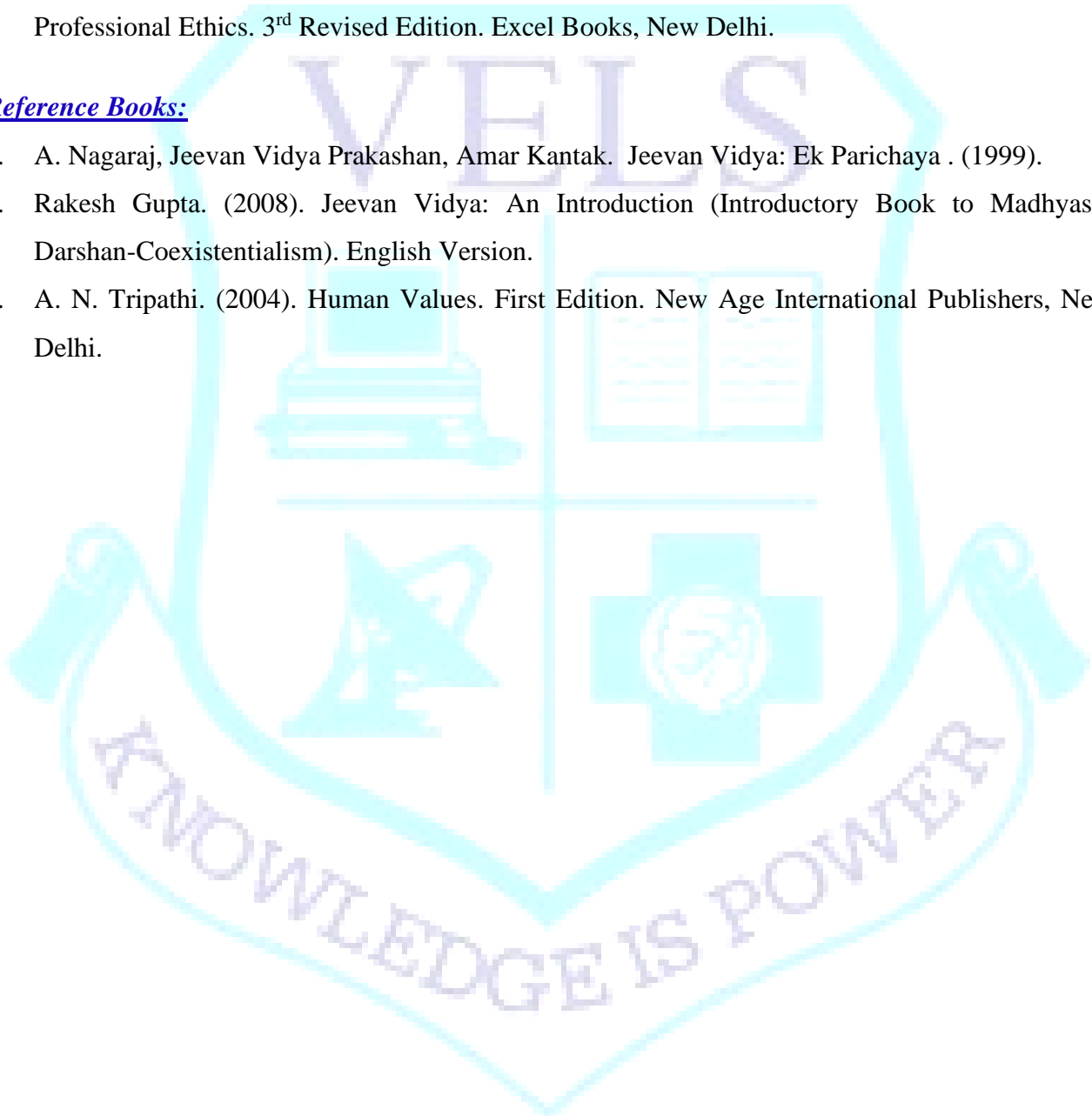
**CO5:** Apply what they have learnt to their own self in real life settings.

**Text Books:**

1. R.R. Gaur, R. Asthana, G.P. Bagaria. (2023). A Foundation Course in Human Values and Professional Ethics. 3<sup>rd</sup> 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.



L	T	P	O	C
2	0	0	1	2

**24SSKU11**

**SOFT SKILLS I**

**COURSE OBJECTIVES:**

**CO1:** To learn and apply basic etiquette for personal and professional interactions.

**CO2:** To develop effective stress management techniques for maintaining mental and emotional well-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 rapidly changing world.

**CO5:** To foster creativity and critical thinking skills for innovative problem-solving and adaptability.

**Credits Hours**

**UNIT I INTRODUCTION TO SOFT SKILLS**

**6**

- Soft Skills vs Hard Skills
- 15 important Soft Skills
- Communication Skills, Time Management, Leadership Skills

**UNIT II - OVERVIEW OF 21<sup>ST</sup> 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**

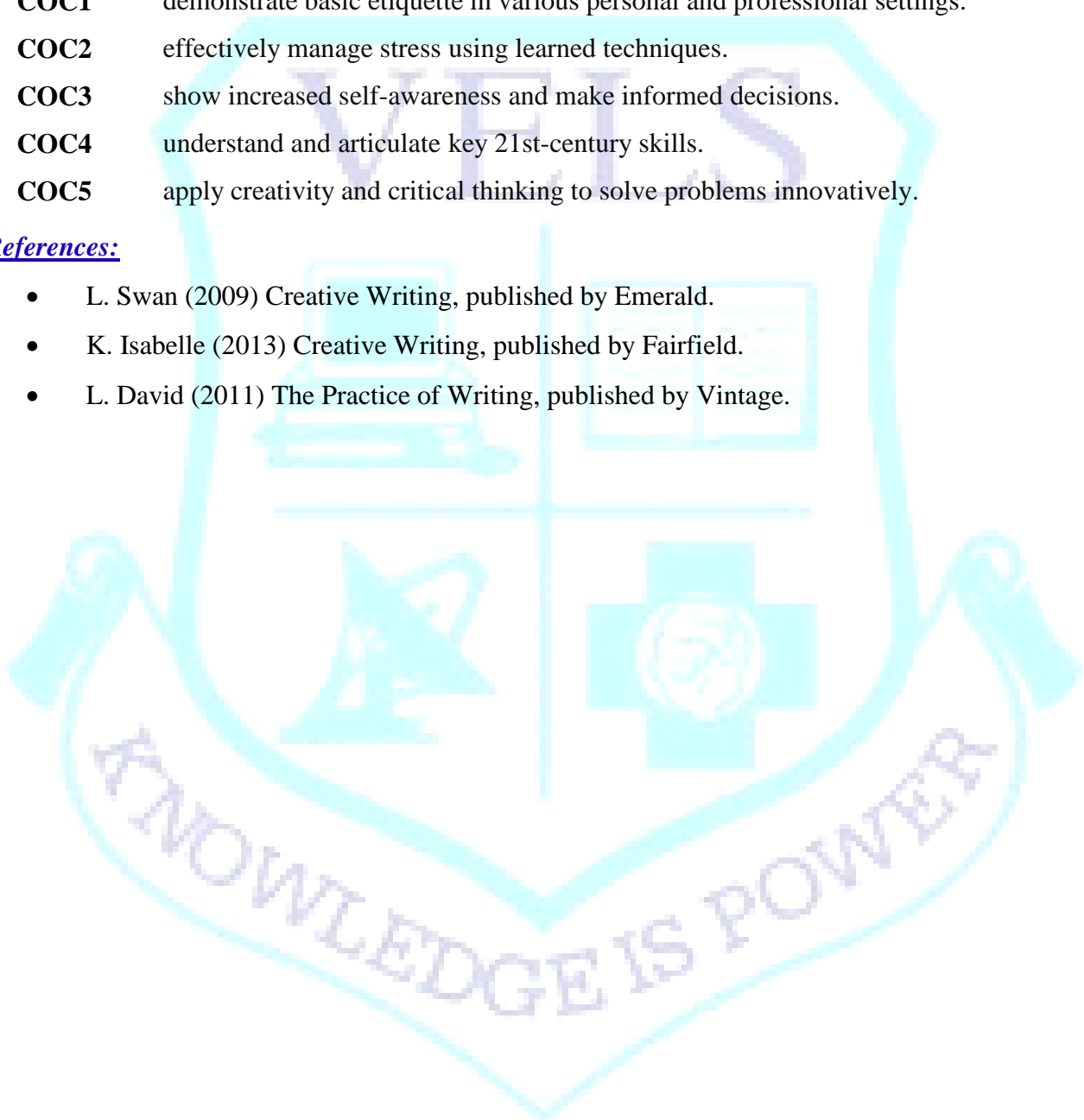
**Course Outcomes:**

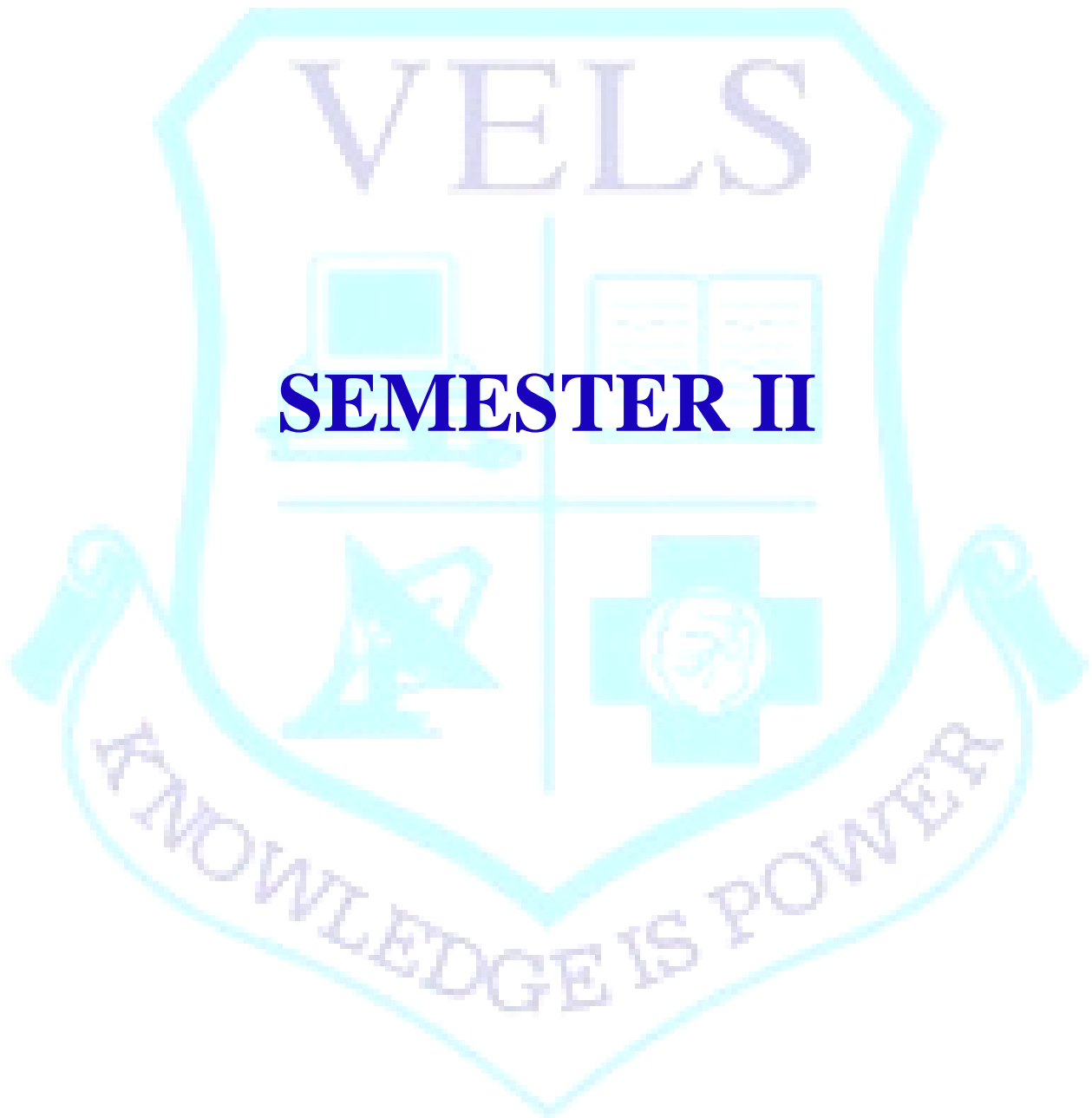
At the end of this course, the students would have learnt to

- 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.





**SEMESTER II**

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

L	T	P	O	C
2	0	0	1	2

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**

**8 மணி 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 (திருப்பலம்பல்)

2. ஆண்டாள் – திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)

✓ மார்கழித் திங்கள் ... (பாசரம் 1)

✓ ஓங்கி உலகளந்த... (பாசரம் 3)

✓ ஆழிமழைக் கண்ணா... (பாசரம் 4)

3. வீரமாமுனிவர் – தேம்பாவணி – வளன் செனித்தப் படலம்

4. சீறாப்புராணம்- மானுக்கு பிணை நின்ற படலம்

**அலகு 3 கலைகள்**

**7 மணி நேரம்**

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

**அலகு 4 நாகரிகம், பண்பாடு**

**7 மணி நேரம்**

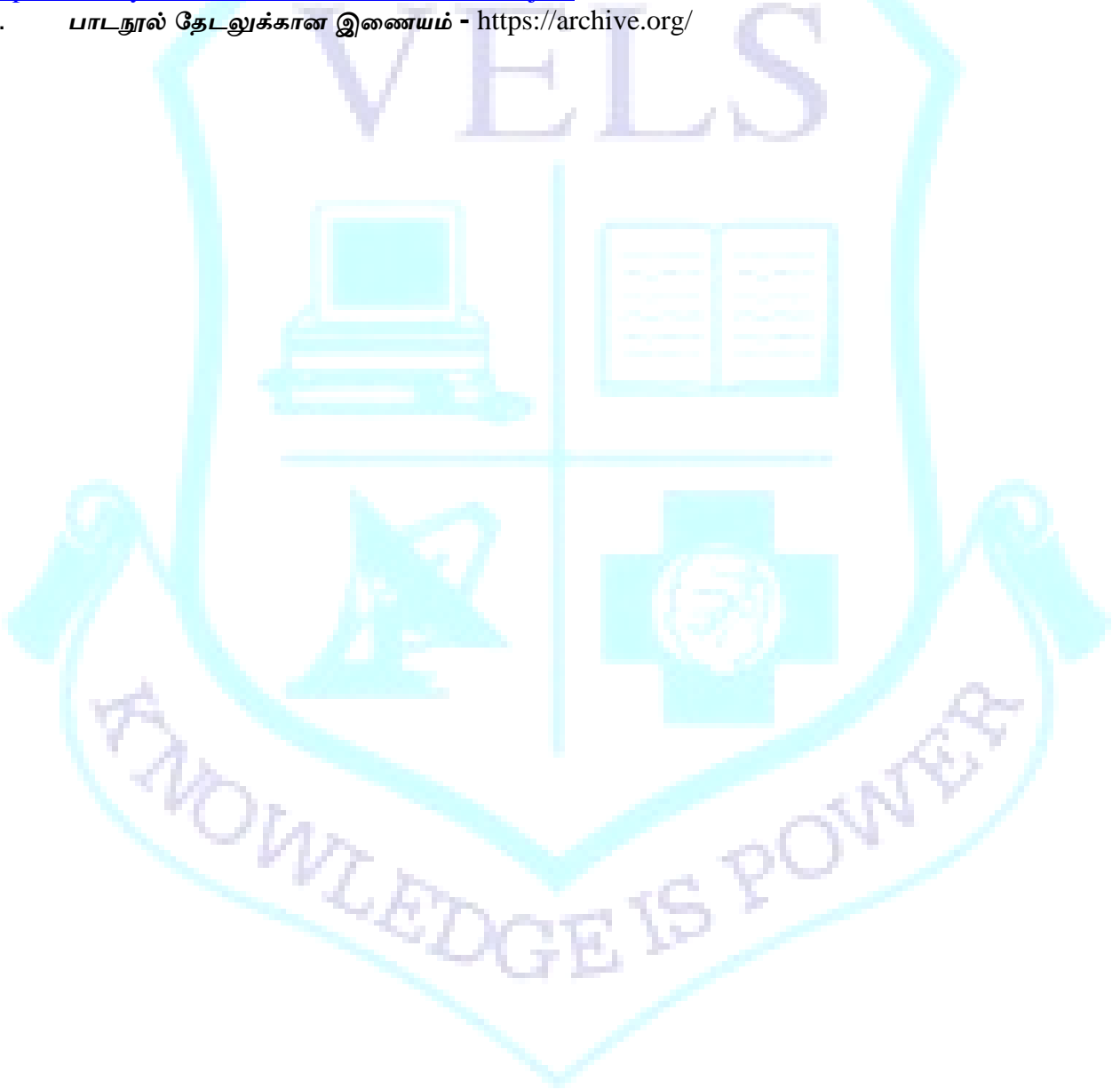
சொற்பொருள் விளக்கம் – பண்டைத் தமிழர் வாழ்வியல் – அகம் – களவு – கற்பு – குடும்பம் – விருந்தோம்பல் – உறவு முறைகள் – சடங்குகள் – நம்பிக்கைகள் – பொழுதுபோக்கு – புறம் – போர் முறைகள் – நடுகல் வழிபாடு – கொடைப்பண்பு.

**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 அக்காடெமி, 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/>



24LHIN21

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

L	T	P	O	C
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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 – तकनीकी शब्द, 50 – पदनाम व  
विभागीय नाम, भाव एक भाषा अनेक**

Functional Hindi 1 - 50-Technical Words, 50-Designation &  
Department Names, Bhav Ek Bhasha Anek

6hrs.

**UNIT V: व्यावहारिक हिन्दी 2 – पत्र लेखन – 3 औपचारिक पत्र,  
इन्स्क्रिप्ट कीबोर्ड का परिचय**

Functional Hindi 2 -Letter Writing- 3 Official Letters.  
Introduction to Inscript Keyboard

6hrs.

**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.m.wikipedia.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

hours L'imperatif, 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 3 Belle vue sur la mer --** 4 hours

Les adjectifs démonstratifs, Y- pronom complément.

**UNIT 4 Quel beau voyage!** 4 hours

Les verbes pronominaux, En- pronom complément.

**UNIT 5 joli** 5 hours

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

**UNIT 6 Et après?** 7 hours

Le futur simple, Le subjonctif présent.

**Total hours- 30 hours**

**COURSE OUTCOME**

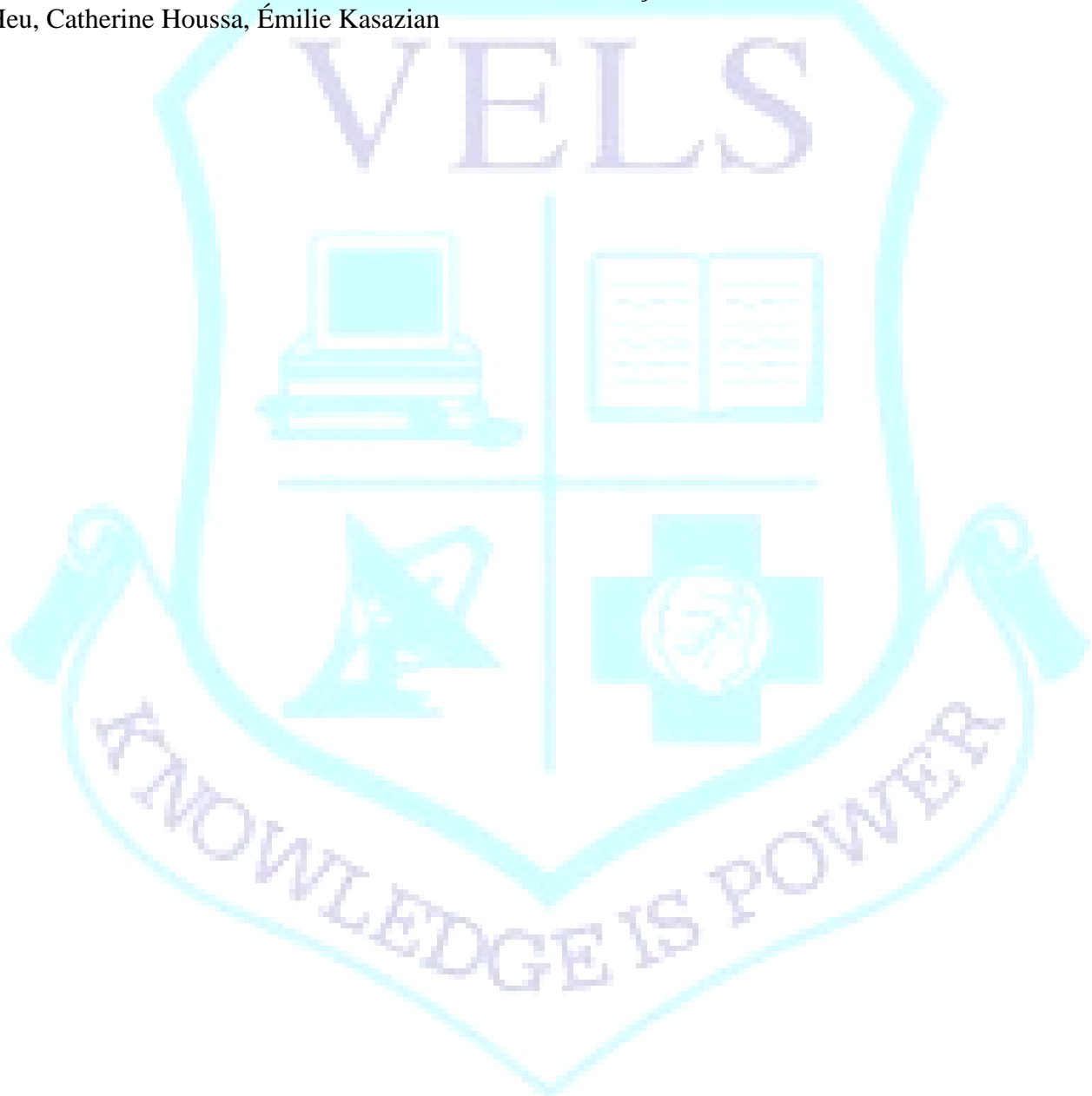
- The students would be able to express his/her where about and to ask direction
- The students would be able to express obligation and restriction
- The students would be able to describe a place
- The students would be able to narrate and to question
- The students would be able to describe someone

- 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



**24LENG21**

**ENGLISH – II**

L	T	P	O	C
2	0	0	1	2

**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.

	<b>Credit Hours</b>
<b>UNIT I - PROSE</b> <ul style="list-style-type: none"><li>• If you are wrong, admit it- Dale Carnegie</li><li>• Words of Wisdom- Chetan Bhaghat</li></ul>	<b>6</b>
<b>UNIT II - POETRY</b> <ul style="list-style-type: none"><li>• La Belle Dame Sans Merci - John Keats</li><li>• Ozymandias- P.B.Shelley</li></ul>	<b>6</b>
<b>UNIT III – FICTION</b> <ul style="list-style-type: none"><li>• The School for Empathy - E.V. Lucas</li><li>• The Lamb to the Slaughter-Roald Dahl</li></ul>	<b>6</b>
<b>UNIT IV – GRAMMAR</b> <ul style="list-style-type: none"><li>• Types of sentences, Concord</li></ul>	<b>6</b>
<b>UNIT V – GRAMMAR</b> <ul style="list-style-type: none"><li>• Tenses, Voices</li></ul>	<b>6</b>
	<b>Total: 30 hours</b>

**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

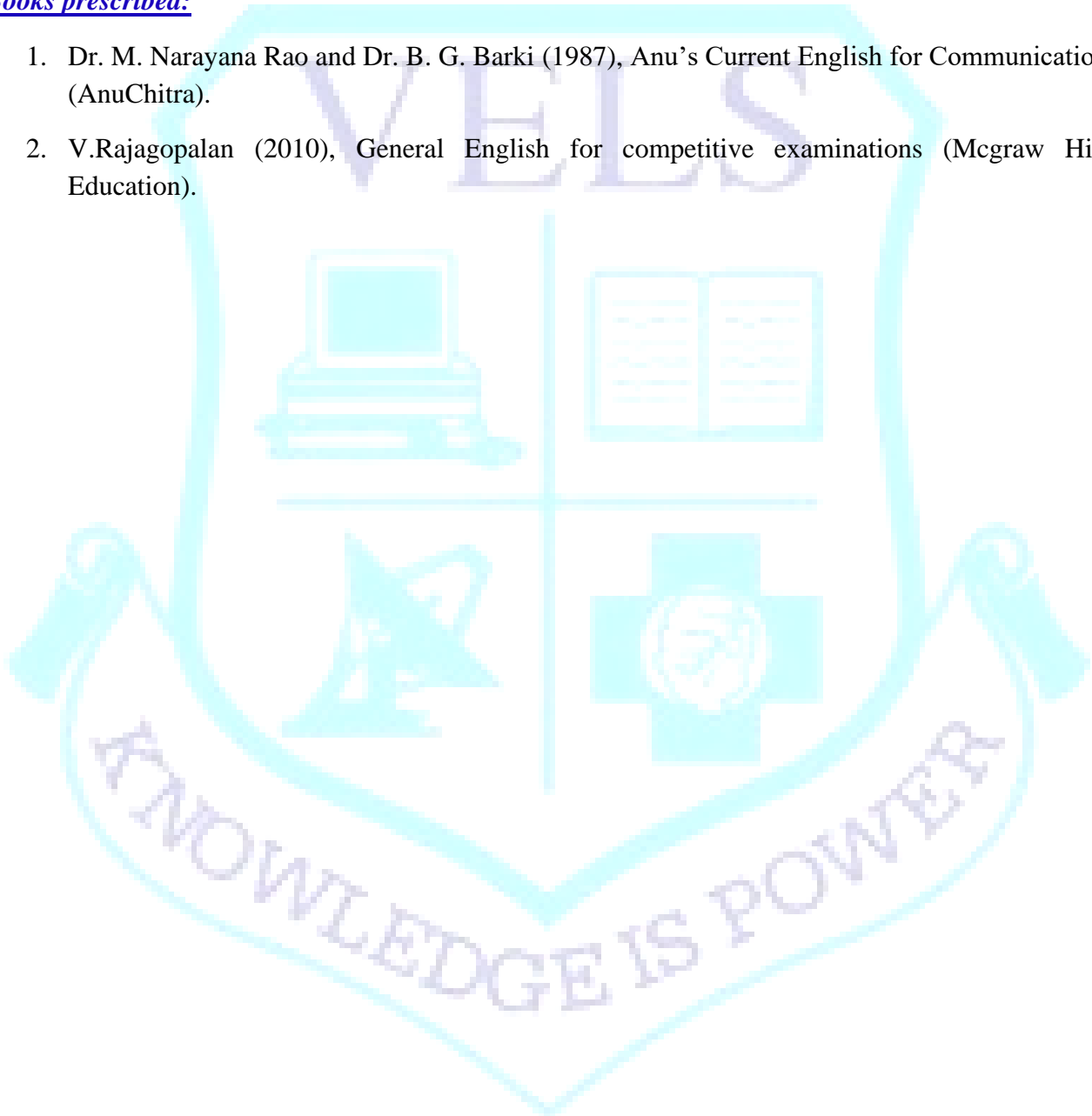
CO-3 Students will develop skills that enable them to communicate effectively in writing

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 (1987), Anu's Current English for Communication (AnuChitra).
2. V.Rajagopalan (2010), General English for competitive examinations (Mcgraw Hill Education).



**24CBBT21 FUNDAMENTALS OF MICROBIOLOGY**

L	T	P	O	C
3	0	0	2	3

**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 of Microbiology & Immunology, Elsevier, India.
3. Pelczar M.J, Chan ECS, King NR, McGraw – Hill, Inc. 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.

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 distributors, 7<sup>th</sup> edition.
2. Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. (1996), Harpers Biochemistry. Appleton and Lange, Stanford, 24<sup>th</sup> edition.
3. Thomas M. Devlin (2010), Textbook of Biochemistry with clinical correlations. Wiley Liss Publishers, 7<sup>th</sup> 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, 6<sup>th</sup> Edition.
6. Donald Voet & Judith G (2010), Voet. Biochemistry. John Wiley and Sons, Inc.4<sup>th</sup> edition.
7. Rama Rao (2006), Textbook of Biochemistry. UBS Publishers' Distributors Pvt. Limited, 9<sup>th</sup> edition.
8. Deb (2001), Textbook of Biochemistry. New Central Book Agency (p) Ltd, 9<sup>th</sup> edition.

## 24MBBT12 PHYTOCHEMISTRY AND HERBAL MEDICINE

L	T	P	O	C
3	0	0	2	3

### 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), 1<sup>st</sup> 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.

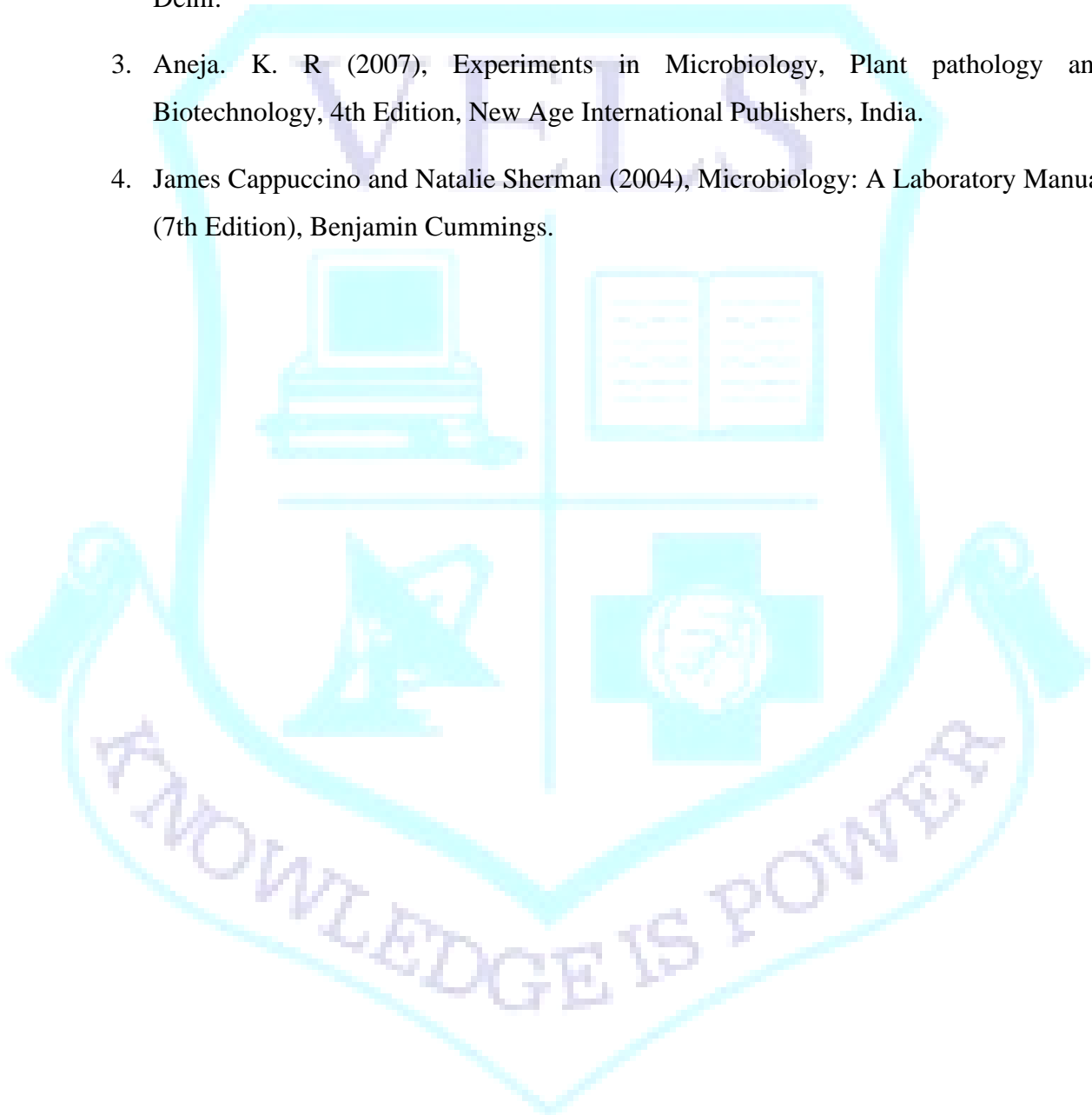
**CO-3:** To know the detailed process of Gram Staining, its procedure and negative staining.

**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  $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ .
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.

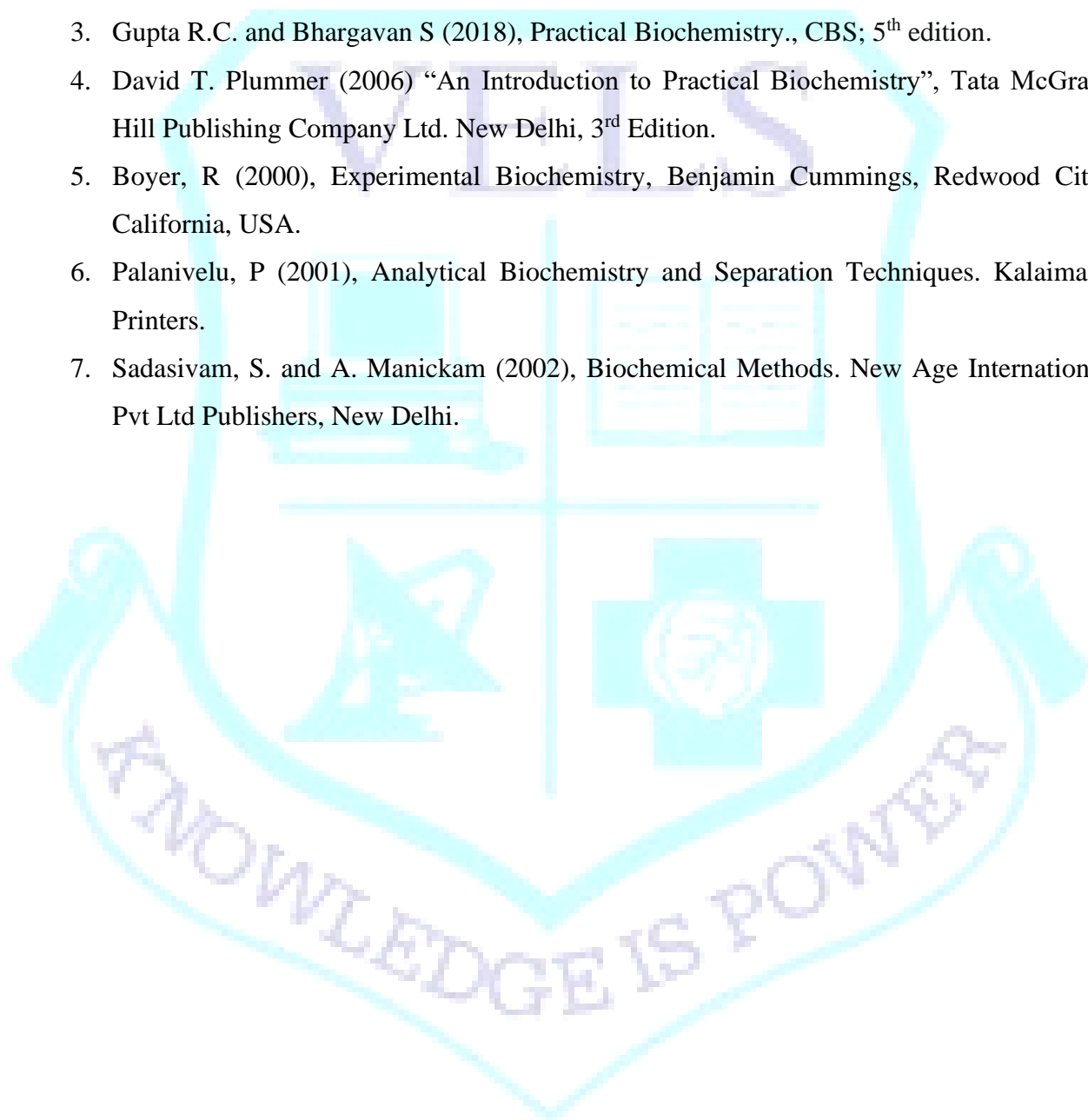
**CO-3:** Examine knowledge in analysing various biomolecules both quantitatively and qualitatively.

**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, 2<sup>nd</sup> Edition, New Age International Private Limited.
2. Sawhney S. K., Randhir Singh (2014), Eds, Introductory Practical Biochemistry, 5<sup>th</sup> or later edition, Narosa Publishing House, New Delhi.
3. Gupta R.C. and Bhargavan S (2018), Practical Biochemistry., CBS; 5<sup>th</sup> edition.
4. David T. Plummer (2006) “An Introduction to Practical Biochemistry”, Tata McGraw Hill Publishing Company Ltd. New Delhi, 3<sup>rd</sup> 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 various contexts.

**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**

**COC1:** enhance participants' business communication skills

**COC2:** enhance LSRW Skills (LSRW – Listening, Speaking, Reading & Writing)

**COC3:** express opinions at free will in social/ personal gathering

**COC4:** impact leadership qualities among participants

**COC5:** engage in conversation with others to exchange ideas

### **References:**

- Andreja. J. Ruther Ford (2011), Basic communication skills for Technology, 2nd Edition, Pearson Education.
- Barun K Mitra (2011), Personality development and soft skills, 1<sup>st</sup> Edition, Oxford Press.
- Elizabeth Harren (2022), last updated: 16 November, 2023
- Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler (McGraw-Hill)
- Ethan Beute and Stephen Pacinelli (Greenleaf)
- Soft skills and professional communication, Francis Peters SJ, 1st Edition, McGraw Hill Education, 2011

**24SSKU21**

**SOFT SKILLS II**

L	T	P	O	C
2	0	0	1	2

**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**

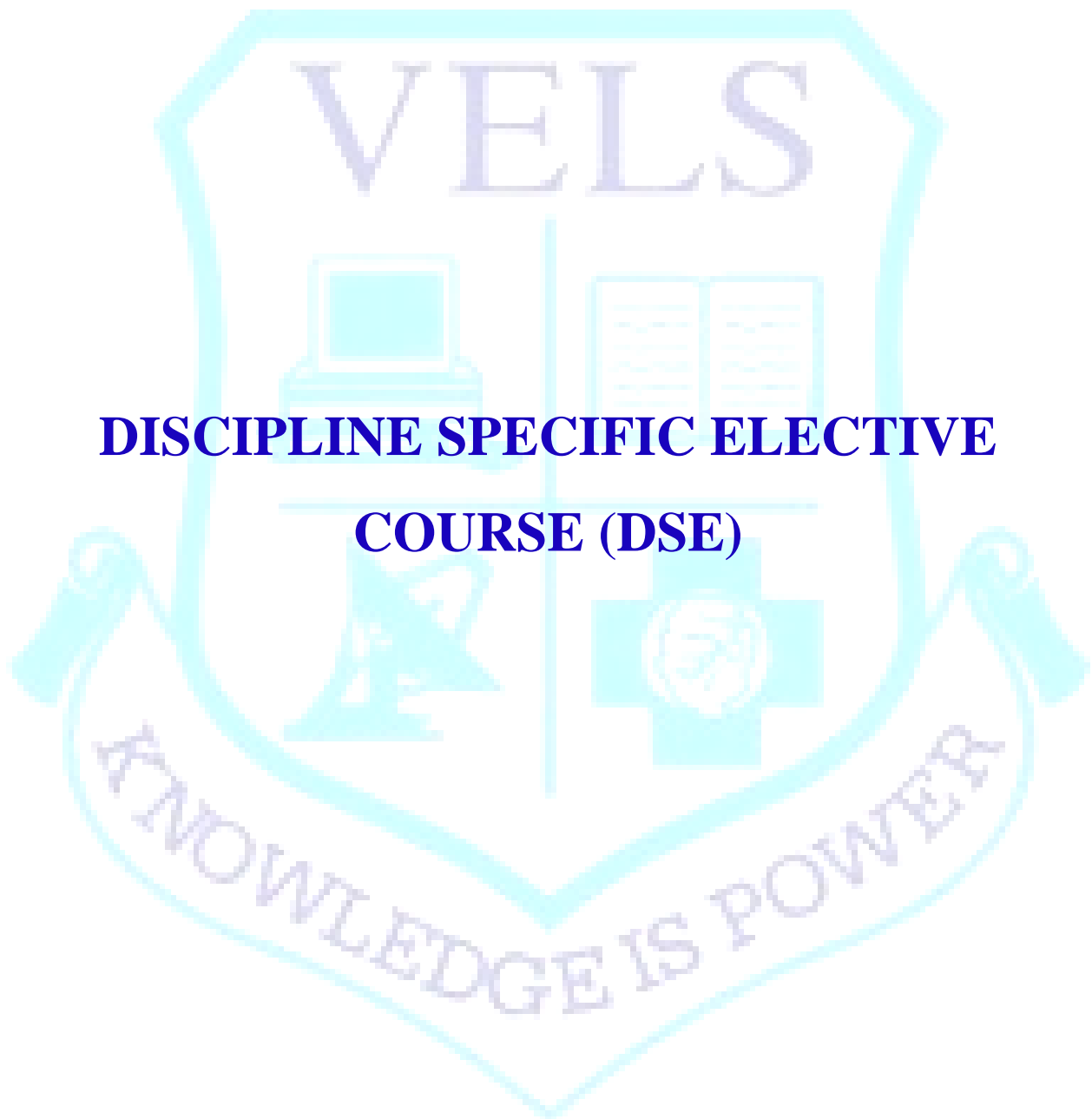
**Course Outcome:**

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

- COC1** understand the principles of effective team building and apply strategies to foster team bonding and cohesion in professional settings.
- COC2** become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills.
- COC3** practice techniques for effective communication in telephone conversations.
- COC4** evaluate decision-making processes and their implications in professional settings.
- COC5** 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.



**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.

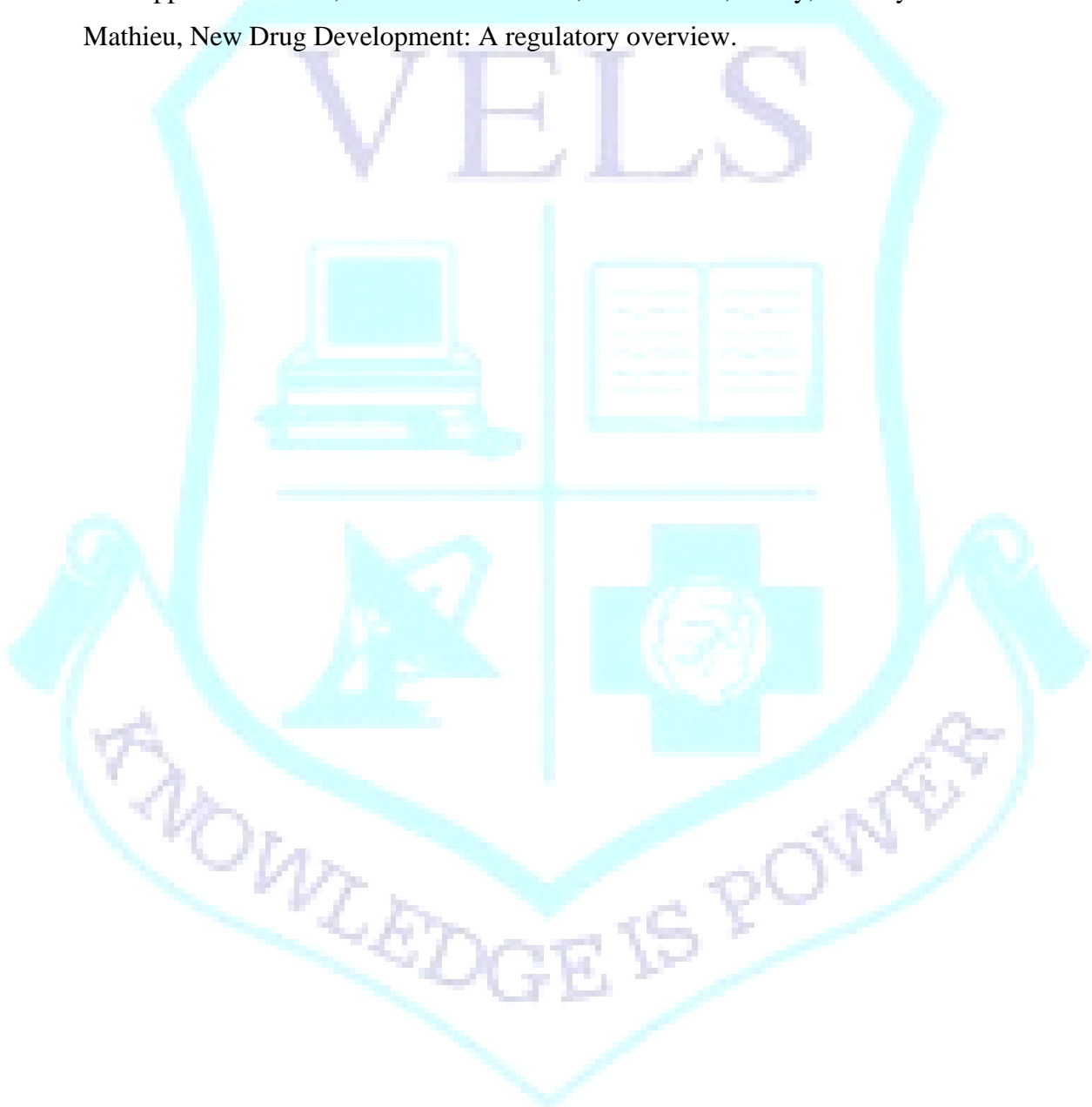
**CO-7:** Assess biosafety measures and industrial hygiene practices to mitigate risks associated with laboratory operations.

**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 overview.



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.

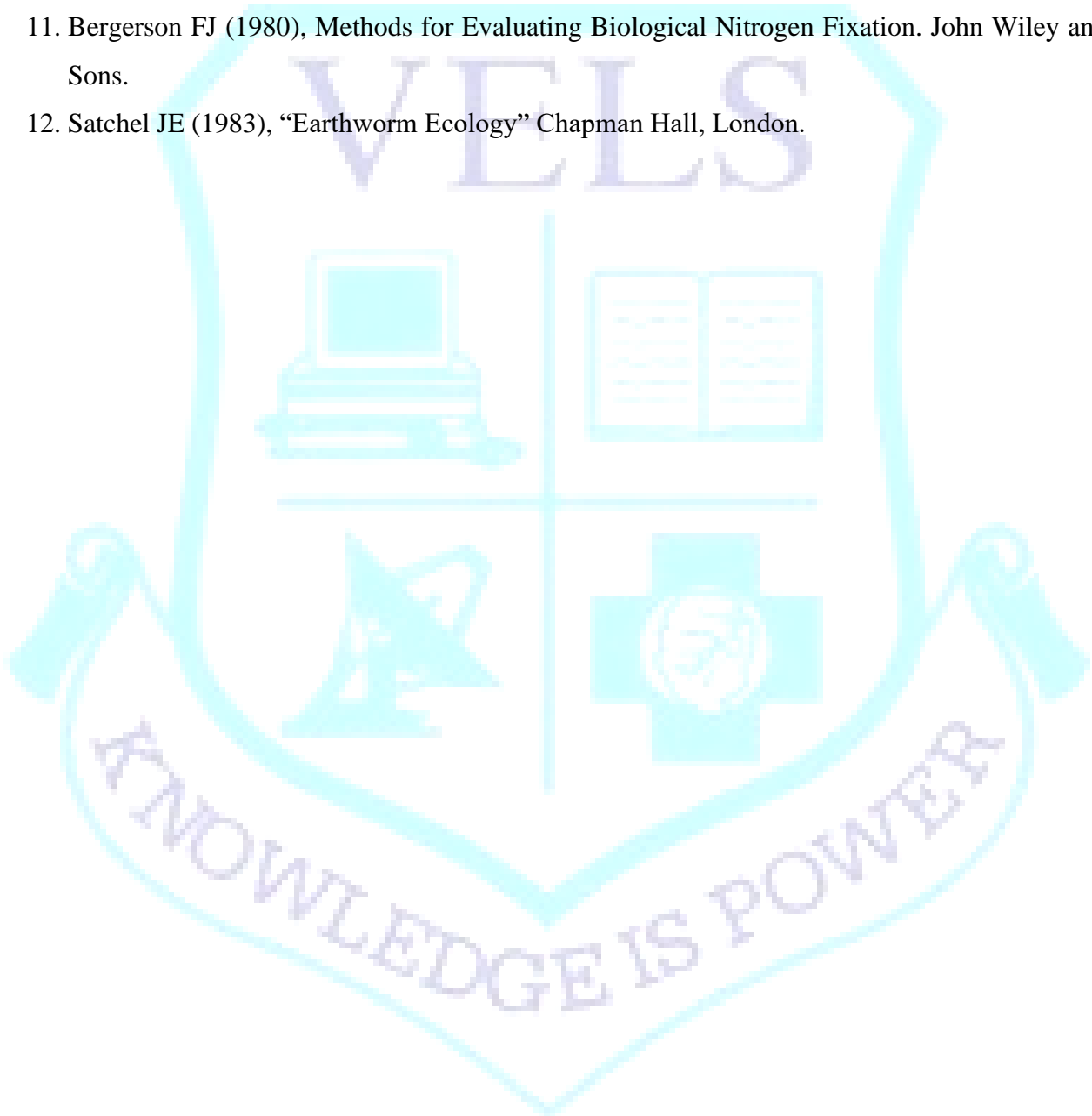
**CO-6:** Acquire knowledge on different types of Biofertilizers produced from microbes.

**CO-7:** Analyze the scope of vermicomposting and the optimum condition 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.



## 24DBBT21 ENVIRONMENTAL BIOTECHNOLOGY

L	T	P	O	C
4	0	0	2	4

### 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. 5<sup>th</sup> 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

**24DBBT22**

**BIOINSTRUMENTATION**

L	T	P	O	C
4	0	0	2	4

**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 (4th Review 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, New York.
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.