

## **Dr. N.G.P.ARTS AND SCIENCE COLLEGE (Autonomous)**

### **REGULATIONS 2019-20 for Under Graduate Programme (Outcome Based Education model with Choice Based Credit System)**

#### **B.Sc. Biotechnology Degree**

(For the students admitted during the academic year 2021-22 and onwards)

#### **Programme: B.Sc. Biotechnology**

##### **Eligibility**

A candidate who has passed in Higher Secondary Examination with any Academic Stream or Vocational Stream as one of the subjects under Higher Secondary Board of Examination and as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **Bachelor of Biotechnology Degree Examination** of this College after a programme of study of three academic years.

##### **Programme Educational Objectives**

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To demonstrate a substantial understanding of concepts in key areas of Biotechnology and its applications.
2. To supplement the academic input of students by way of seminars, conferences, guest lectures and industrial visits.
3. To describe the common methods and applications of biotechnology with regards to microorganisms, plants, animals and Pharma industries.



**PROGRAMME OUTCOMES:**

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Students will be able to identify, analyze and understand problems related to biotechnology and finding valid conclusions with basic knowledge in biotechnology.
PO2	Graduates will be able to justify societal, health, safety and legal issues and understand his responsibilities in biotechnological practices.
PO3	Provide education that leads to comprehensive understanding of the principles and practices of biotechnology that will help to undertake any responsibility as an individual and as a team in a multidisciplinary environment.
PO4	Graduates will be able to demonstrate knowledge of project management when dealing with Biotechnology problems.
PO5	Students will possess hands-on technical skills necessary for supporting biotechnology research activity and empower students with the ability to think and solve problems in the field of biotechnology.





**Guidelines for Programmes offering Part I & Part II for Four Semesters:**

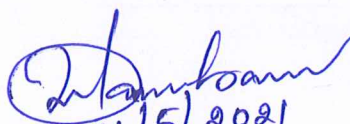
Part	Subjects	No.of Papers	Credit	Semester No.
I	Tamil / Hindi / French/Malayalam	4	4 x 3 = 12	I to IV
II	English	4	4 x 3 = 12	I to IV
III	Core (Credits 2,3,4 )	14-16	58	I to VI
	Inter Departmental Course (IDC)	-	16	I to IV
	Discipline Specific Elective (DSE)	3	3 x 4 =12	V & VI
	Skill Enhancement Course (SEC)	4	4 x 3=12	III ,IV,V& VI
	Generic Elective (GE)	2	2 x 2=4	III & IV
	Lab on Project (LoP)	1	1	III to V
IV	Environmental Studies(AECC)	1	2	I
	Value Education (VE) (Human Rights, Womens' Rights) (AECC)	2	4	II and III
	General Awareness(On-Line Exam) (AECC)	1	2	IV
	RM ( AECC)	1	2	V
	Innovation, IPR, Entrepreneurship (AECC)	1	2	VI
V	Extension Activity NSS / Sports / Department Activity	-	1	I to VI
<b>TOTAL CREDITS</b>			<b>140</b>	




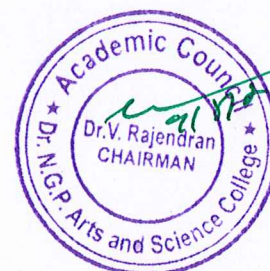
## CURRICULUM

## B.Sc. BIOTECHNOLOGY

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
First Semester										
Part - I										
211TL1A1TA	Language - I	Tamil-I	4	1	-	3	25	75	100	3
201TL1A1HA		Hindi-I								
201TL1A1MA		Malayalam-I								
201TL1A1FA		French – I								
Part - II										
211EL1A1EA	Language - II	Professional English – I		-	1	3	25	75	100	3
Part - III										
193BT1A1CA	Core I	Cell Biology	4	1	-	3	25	75	100	3
193BT1A1CB	Core II	Biodiversity	4	1		3	25	75	100	3
193BT1A1CP	Core Practical - I	Cell Biology & Biodiversity	-	-	4	5	40	60	100	2
192CE1A1IB	IDC – I	Chemistry for Biologists	3	1	-	3	25	75	100	4
Part - IV										
193MB1A1AA	AECC - I	Environmental Studies	2	-	-	2	-	50	50	2
Total			21	4	5	-	-	-	650	20

  
 14/5/2021  
 BoS Chairman/HoD  
 Department of Biotechnology  
 Dr. N. G. P. Arts and Science College  
 Coimbatore - 641 048

 <b>Dr.N.G.P. Arts and Science College</b>		
<b>APPROVED</b>		
BoS- 11 <sup>th</sup> 17.05.2021	AC- 11 <sup>th</sup> 09.08.2021	GB- 15 <sup>th</sup> 17.08.2021



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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
Part - I										
191TL1A2TA	Language - I	Tamil-II	4	1	-	3	25	75	100	3
201TL1A2HA		Hindi-II								
201TL1A2MA		Malayalam-II								
201TL1A2FA		French - II								
Part - II										
211EL1A2EA	Language - II	Professional English - II	4	-	1	3	25	75	100	3
Part - III										
193BT1A2CA	Core III	Molecular Biology	4	1	-	3	25	75	100	3
193BT1A2CB	Core IV	Microbiology	4	1	-	3	25	75	100	3
193BT1A2CP	Core Practical II	Molecular Biology & Microbiology	-	-	4	5	40	60	100	2
194CT1A2IC	IDC - II	Computers for Biologists	4	-	-	3	25	75	100	4
Part - IV										
196BM1A2AA	AECC - II	Human Rights	2	-	-	2	-	50	50	2
Total			22	3	5	-	-	-	650	20



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
Part - I										
191TL1A3TA	Language - I	Tamil-III	3	1	-	3	25	75	100	3
191TL1A3HA		Hindi-III								
191TL1A3MA		Malayalam-III								
201TL1A3FA		French - III								
Part - II										
191EL1A3EA	Language - II	English - III	3	-	1	3	25	75	100	3
Part - III										
193BT1A3CA	Core V	Genetics	3	1	-	3	25	75	100	3
193BT1A3CB	Core VI	Biochemistry	2	1		3	25	75	100	3
193BT1A3CP	Core practical III	Genetics & Biochemistry	-	-	4	6	40	60	100	2
192MT1A3ID	IDC - III	Mathematics	3	1	-	3	25	75	100	4
193BT1A3SA	SEC-I	Personality Development	3	-	-	3	25	75	100	3
193BT1A3GA	GE - I	Mushroom Technology	2	-	-	2	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A3AA 191TL1A3AB 195CR1A3AA	AECC- III	Basic Tamil	2	-	-	2	-	50	50	2
		Advanced Tamil								
		Women's Rights								
Total			21	4	5	-	-	-	800	25





Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
Part - I										
191TL1A4TA	Language - I	Tamil-IV	3	1	-	3	25	75	100	3
191TL1A4HA		Hindi-IV								
191TL1A4MA		Malayalam-IV								
191TL1A4FA		French - IV								
Part - II										
191EL1A4EA	Language - II	English - IV	3	-	1	3	25	75	100	3
Part - III										
193BT1A4CA	Core VII	Immunology	3	1	-	3	25	75	100	3
193BT1A4CB	Core VIII	Bioinformatics	2	1	-	3	25	75	100	3
193BT1A4CP	Core Practical IV	Immunology& Bioinformatics	-	-	4	3	40	60	100	2
192PY1A4IA	IDC - IV	Biophysics	3	1	-	3	25	75	100	4
193BT1A4SA	SEC - II	Biotechniques	2	1	-	3	25	75	100	3
193BT1A4GA	GE - II	Apiculture	2	-	-	2	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A4AA	AECC IV	Basic Tamil	2	-	-	2	-	50	50	2
191TL1A4AB		Advanced Tamil								
192PY1A4AA		General Awareness								
Total			20	5	5	-	-	-	800	25



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fifth Semester										
Part – III										
193BT1A5CA	Core IX	Recominant DNA Technology	4	1	-	3	25	75	100	4
193BT1A5CB	Core X	Plant & Animal Biotechnology	4	1	-	3	25	75	100	4
193BT1A5CC	Core XI	Bioprocess Technology	4	1	-	3	25	75	100	3
193BT1A5CP	Core Practical V	rDNA, Bioprocess, Plant & Animal Biotechnology	-	-	5	6	40	60	100	2
193BT1A5SA	SEC III	Entrepreneurial Biotechnology	3	1	-	3	25	75	100	3
193BT1A5DA	DSE - 1	Clinical Trials	3	1	-	3	25	75	100	4
193BT1A5DB		Biomaterials								
193BT1A5DC		Food Biotechnology								
193BT1A5LA	LoP	Lab on Project	-	-	-	-	50	-	50	1
193BT1A5CT	IT	Industrial Training	Grade A to C							
Part - IV										
192MT1A5AA	AECC- V	Research Methodology	2	-	-	2	-	-	50	2
Total			20	5	5	-	-	-	700	23





Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Sixth Semester										
Part – III										
193BT1A6CA	Core- XII	Bioprospecting	3	1	-	3	25	75	100	4
193BT1A6CB	Core - XIII	Environmental Biotechnology	3	1	-	3	25	75	100	4
193BT1A6CC	Core- XIV	Bionanotechnol ogy	3	1		3	25	75	100	3
193BT1A6CP	Core practical VI	Bioprospecting, Environmental Biotechnology and Bionanotechnol ogy	-	-	5	6	40	60	100	2
193BT1A6SA	SEC - IV	Pharmaceutical Biotechnology	2	1	-	3	25	75	100	3
193BT1A6DA	DSE - II	Genomics	3	1	-	3	25	75	100	4
193BT1A6DB		Bioethics & Biosafety								
193BT1A6DC		Drug Design & Delivery								
193BT1A6DD	DSE - III	Proteomics	3	1	-	3	25	75	100	4
193BT1A6DE		Biomarker Technology								
193BT1A6DF		Stem Cell Technology								
Part - IV										
193BC1A6AA	AECC - VI	Innovation, IPR & Entrepreneurship	2	-	-	2	-	-	50	2
Part - V										
193BT1A6XA		Extension Activity	-	-	-	-	-	-	50	1
Total			19	6	5				800	27
Grand Total									4400	140



### DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters V & VI

#### Semester V (Elective I)

##### List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT1A5DA	Clinical Trials
2.	193BT1A5DB	Biomaterials
3.	193BT1A5DC	Food Biotechnology

#### Semester VI (Elective II)

##### List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT1A6DA	Genomics
2.	193BT1A6DB	Bioethics & Biosafety
3.	193BT1A6DC	Drug Design & Delivery

#### Semester VI (Elective III)

##### List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT1A6DD	Proteomics
2.	193BT1A6DE	Biomarker Technology
3.	193BT1A6DF	Stem Cell Technology





### GENERIC ELECTIVE COURSES (GE)

The following are the courses offered under Generic Elective Course

#### Semester III (GE-I)

S. No.	Course Code	Course Name
1	193BT1A3GA	Mushroom Technology

#### Semester IV (GE-II)

S. No.	Course Code	Course Name
1	193BT1A4GA	Apiculture

### EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No.	Course Code	Course Name
1	193BT1ASSA	Environmental Management
2	193BT1ASSB	Biofertilizer Technology

### CERTIFICATE PROGRAMMES

The following are the programme offered to earn extra credits:

S. No.	Programme Code and Name	Course Code	Course Name
1	Certificate Course on Plant Tissue Culture	193BT5A1CA	Plant Tissue Culture
2	Certificate Course on Protein Purification and Characterization	193BT5A1CB	Protein Purification and Characterization



## MOOC (NPTEL/SWAYAM/ SPOKEN TUTORIAL)

The following are the online courses offered:

Please refer the following link to select the courses

- [www.swayam.org](http://www.swayam.org)
- [www.nptel.ac.in](http://www.nptel.ac.in)
- [www.spoken-tutorial.org](http://www.spoken-tutorial.org)



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## REGULATION 2019-20

Effective from the academic year 2019-20 and applicable to the students admitted to the Degree of Bachelor of Science / Commerce/ Arts.

### 1. NOMENCLATURE

1.1 Faculty: Refers to a group of programmes concerned with a major division of knowledge are. Eg. Faculty of Computer Science consists of disciplines like Departments of Computer Science, Information Technology, Computer Technology and Computer Applications.

1.2 Programme: Refers to the Bachelor of Science / Commerce / Arts Stream that a student has chosen for study.

1.3 Batch: Refers to the starting and completion year of a programme of study. Eg. Batch of 2015–2018 refers to students belonging to a 3 year Degree programme admitted in 2015 and completing in 2018.

1.4 Course Refers to a component (a paper) of a programme. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ practical training / report writing / Viva voce, etc or a combination of these, to meet effectively the teaching and learning needs and the credits may be assigned suitably.

#### a) Core Courses

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

#### b) Inter Disciplinary Course (IDC)

A course chosen generally from a related discipline/subject, with an intention to seek exposure in the discipline relating to the core domain of the student.

#### c) Discipline Specific Elective (DSE) Course: DSE courses are the courses offered by the respective disciplinary/ interdisciplinary programme.

#### d) Skill Enhancement Courses (SEC): SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

#### e) Ability Enhancement Courses (AEC): AECC courses are the courses based upon the content that leads to Knowledge enhancement. These



are mandatory for all disciplines. Environmental Science, Human Rights, Women's Rights, General Awareness, IPR and Innovation, Entrepreneurship Development and Research Methodology.

All these courses should be taught according to Outcome based Education.

### 1.5 Lab on Project (LoP)

To promote the undergraduate research among all the students, the LoP is introduced beyond their regular class hours. LoP is introduced as group project consisting of not more than five members. It consist of four stages namely Literature collection, Identification of Research area, Execution of research and Reporting / Publication of research reports/ product developments. These four stages spread over from III to V semester.

### 1.6 Project work

It is considered as a special course involving application of knowledge in problem solving / analyzing /exploring a real life situation / difficult problem. The Project work will be given in lieu of a Core paper.

### Extra credits

Extra credits will be awarded to a student for achievements in co-curricular activities carried out outside the regular class hours. The guidelines for the award of extra credits are given in section- these credits are not mandatory for completing the programme.

### Advanced Learner Course (ALC):

ALC is doing work of a higher standard than usual for students at that stage in their education. Research work carried out in University/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days will be considered as Advanced Learners Course.





## 2. STRUCTURE OF PROGRAMME

### 2.1 PART – I: LANGUAGE

Tamil or any one of the languages namely Malayalam, Hindi and French will be offered under Part – I in the first two / four semesters.

### 2.2 PART – II : ENGLISH

English will be offered during the first two / four semester.

### 2.3 PART – III :

- Core course
- Inter Departmental Course (IDC)
- Discipline Specific Elective (DSE)
- Skill Enhancement Course (SEC)
- Generic Elective (GE)
- Lab on Project (LoP)
- Industrial Training (IT)

### 2.4 PART IV

#### 2.4.1 Ability Enhancement Compulsory Course

The ability enhancement courses such as i) Environmental Studies, ii) Human Rights, iii) Womens' Rights, iv) General Awareness, v) Research Methodology, vi) Intellectual Property Rights(IPR), Innovation and Entrepreneurship or IPR and Innovation from I to VI Semester.

a) Those who have not studied Tamil up to XII Std and taken a non-Tamil language under Part-I shall take Tamil comprising of two courses.

(OR)

b) Those who have studied Tamil up to XII std and taken a non-Tamil language under Part-I shall take Advanced Tamil comprising of two courses in the third and fourth semesters.

(OR)

c) Students who come under the above a+b categories are exempted from Women's Rights and General awareness during III and IV semester respectively.



## 2.5 PART V: EXTENSION ACTIVITIES

The following co-curricular and extracurricular activities are offered under institutional / department Association/ club/ extension programmes for the students under extension activities from I to IV semester.

### a) Institutional

- National Service Scheme (NSS)  
Participation in any one of the camps organized by NSS unit.
- Friends of Police (FoP)  
Active participation in traffic regulation and other extension activities
- Sports  
Active participation in any one of the sports activities
- Youth Red Cross (YRC)  
Active participation in YRC programmes

### b) Department Association

Membership and active participation in the department association activities.

### c) Clubs

Membership and active participation in any one club activities.

## 1. CREDIT ALLOTTMENT

The following is the credit allotment:

- Lecture Hours (Theory) : Max.1 credit per lecture hour per week,  
1 credit per tutorial hour per week
- Laboratory Hours : 1 credit for 2 Practical hours per week.
- Project Work : 1 credit for 2 hours of project work per week

## 2. DURATION OF THE PROGRAMME

A student is normally expected to complete the B.Sc. /B.com. /BA Programme in 6 semesters. However, in any case not more than 7 consecutive semesters. Failing which the concern BoS will identify suitable / equivalent course.



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### 3. REQUIREMENTS FOR COMPLETION OF A SEMESTER

Candidate shall be permitted to appear for the End Semester examinations for any semester (practical/theory) if

- i) He/she secures not less than 75% of attendance in the number of working days during the semester.
- ii) He/she earns a progress certificate from the Head of the institution, of having satisfactorily completed the course of study prescribed in the scheme of examinations for that semester as required by these regulations, and
- iii) His/her conduct / character is satisfactory.
  - Provided that it shall be open to the Academic council, or any authority delegated with such powers by the Academic council, to grant exemption to a candidate who has failed to earn 75% of the attendance prescribed, for valid reasons, subject to usual conditions. (Refer the Ordinance No.1 of 1990 of the Bharathiar University)
  - A candidate who earned 75% of attendance and more in the current semester are eligible to write the examination in current semester subjects.
  - A candidate who has secured less than 65% but 55% and above attendance in any semester has to compensate the shortage in attendance in the subsequent semester besides earning the required percentage of attendance in that semester and appear for both semester papers together at the end of the later semester.
  - A candidate who has secured less than 55% of attendance in any semester shall not be permitted to appear for the regular examinations and to continue the study in the subsequent semester. He/she has to rejoin the semester in which the attendance is less than 55%.
  - A candidate who has secured less than 65% of attendance in the final semester has to compensate his/her attendance shortage in a manner as decided by the concerned Head of the department after rejoining the same course.



#### 4. EXAMINATIONS

- The end semester examinations shall normally be conducted after completing 90 working days for each semester.
- The maximum marks for each theory and practical course (including the project work and Viva-Voce examination in the final Semester) shall be 100 with the following breakup.

##### (i) Theory Courses

Continuous Internal Assessment (CIA) : 25 Marks

End Semester Exams (ESE) : 75 Marks

##### (ii) For Practical/ Courses

Continuous Internal Assessment (CIA) : 40 Marks

End Semester Exams (ESE) : 60 Marks

- a. The following are the distribution of marks for the Continuous Internal Assessment in Practical, Project / Industrial Training Courses.

Continuous Internal Assessment for Practical Courses:

S.No	For - UG practical courses	Distribution of Marks					
1	Minimum 10 experiments to be conducted/practical paper/semester	20	15	10	8	5	4
2	Tests : Two tests out of which one shall be during the mid semester and the other to be conducted as model test at the end of the semester.)	16	10	10	8	6	6
3	Observation Note Book	4	5	5	4	4	-
	TOTAL MARKS	40	30	25	20	15	10





### Project viva-voce / Industrial Training

The following are the distribution of marks for the continuous Internal assessment in UG Project/Industrial Training courses.

S.no	For - UG Project courses//Industrial Training	Distribution of Marks	
1	Review-I	5	10
2	Review-II	5	10
3	Review-III	5	10
4	Document, Preparation and Implementation	10	10
	TOTAL MARKS	25	40

b. Following are the distribution of marks for the External Examination in UG Project /Industrial Training courses

S.no	For - UG Project //Industrial Training courses	Distribution of Marks	
1	Record Work and Presentation	35	40
2	Viva-Voce	15	20
	TOTAL MARKS	50	60

### Part – IV

The courses offered under Part – IV shall have only End Semester Examinations (ESE) for a maximum of 50 Marks. However, Students who select “Tamil” under Part IV, will be assessed only by Continuous Internal Assessment (CIA). The marks shall be furnished to the COE by the concerned Course teacher through the Head of the Department.



## 6.1 CONTINUOUS ASSESSMENT EXAMS

### 6.1 Theory courses

#### a) Continuous Internal Assessment test (CIA)

There will be a Minimum of two Continuous Assessment Exams, for each Theory course. The first and Second Assessment Exams will be conducted for a Maximum of 50 Marks and 75 marks respectively. The total marks secured in the Two Assessment Exams will be converted to 15 Marks.

#### b) Utilization of Library

Marks will be awarded to the student based on the hours spent in the library after the working hours and submission of report by the student.

Hours spent in Library	Marks	Type of Document submitted
2	1	Report/ Assignment/ Class presentation
4	2	
6	3	
8	4	
10	5	
12	6	

- During the Library hour, the student must spend time in reading the articles, books, journals of their subject of interest
- Each student should borrow minimum three books during the semester
- Student is expected to submit one Report / Assignment / Class Presentation per Course.

#### c) Class Participation

Active participation in classroom discussion by the student will be evaluated based on Integration of knowledge, Interaction and Participation and demonstration of knowledge.





## d) Papers / Reports/ Assignments/ Class Presentation

The student will be evaluated based on his ability to do analysis of application of theory to real world problems or creative extension of class room learning and his/her ability to communicate the given topic effectively and clearly.

## Continuous Assessment OBE Rubrics Score Sheet

Degree: \_\_\_\_\_ Branch: \_\_\_\_\_ Semester: \_\_\_\_\_

Course Code: \_\_\_\_\_ Course: \_\_\_\_\_

Max. Marks: \_\_\_\_\_ Internal: \_\_\_\_\_ External: \_\_\_\_\_ Total: \_\_\_\_\_

S.No.	REG. NO	THEORY / PRACTICAL & LIBRARY CLASS PARTICIPATION (15) (Compulsory)				RUBRICS ASSESSMENT (SELECT ANY ONE)									Total Marks out of : 30	Total Marks out of : 16 / 10 / 08 / 04
						PAPERS / REPORTS (15)			ASSIGNMENTS (15)			CLASS PRESENTATION (15)				
		Library	Integration of Knowledge & Interaction & Participation	Demonstration of Knowledge	Organization & Knowledge	Format & Spelling	Reference / Experiments	Demonstration of Knowledge	Format & Spelling	Reference	Content & Coherence	Creativity and Speaking Skills	Duration of Presentation			
1		6	3	3	3	5	5	5	5	5	5	5	5	5		





The following are the distribution of marks for the continuous internal assessment in UG practical courses

S.No	For - UG Practical Courses	Distribution of Marks					
1	Minimum 10 experiments to be conducted/practical paper/semester	20	15	10	8	5	4
2	Tests : Two tests out of which one shall be during the mid semester and the other to be conducted as model test at the end of the semester.)	16	10	10	8	6	6
3	Observation Note Book	4	5	5	4	4	-
	TOTAL MARKS	40	30	25	20	15	10



## 7. FOR PROGRAMME COMPLETION

Programme Completion (for students admitted in the A.Y.2019-20 and Onwards)

Student has to complete the following:

- i) Part I, II,III,IV,V as mentioned in the scheme
- ii) Industrial/ Institutional training

Students must undertake industrial / institutional training for a minimum of 15 days and not exceeding 30 days during the IV semester summer vacation. The students will submit the report for evaluation during V semester.

Based on the performance Grade will be awarded as follows:

Marks Scored	Grade to be awarded
75 and above	A
60-74	B
40-59	C
< 40	Re-Appearence

- iii) Skill Enhancement Training

Student must undergo Skill Enhancement training on Communication skills (I and II Semester) and Quantitative aptitude (III and IV Semester) respectively each for 40 h.





## 8. EXTRA CREDITS

- Earning extra credit is mandatory. However, it is not essential for programme completion
- Extra Credits will be awarded to a student for achievement in co-curricular/ extracurricular activities carried other than the regular class-hours.
- The detailed guidelines for the award of extra credits are as follows:
- A student is permitted to earn a maximum of five extra Credits during the programme duration of UG from I to V Semester.
- Candidate can claim a maximum of 1 credit under each category listed.

The following are the guidelines for the award of Extra credits:

### 8.1 Proficiency in foreign language

Qualification	Credit
A pass in any foreign language in the examination conducted by an authorized agency	1

### 8.2 Proficiency in Hindi

Qualification	Credit
A pass in the Hindi examination conducted by Dakshin Bharat Hindi Prachar Sabha	1

Examination passed during the programme period only will be considered for extra credit

### 8.3 Self-study Course

Qualification	Credit
A pass in the self-study courses offered by the department	1

The candidate should register the self-study course offered by the department only in the III semester



#### 8.4 Typewriting/Short hand

A Pass in short hand /typewriting examination conducted by Tamil Nadu Department of Technical Education (TNDTE) and the credit will be awarded.

Qualification	Credit
A pass in the type writing / short hand examination offered by TNDTE	1

#### 8.5 Diploma / Certificate

Courses offered by any recognized University / NCVRT

Qualification	Credit
A pass in any Certificate course/ Diploma / PG Diploma	1

#### 8.6 CA/ICSI/CMA

Qualification	Credit
Qualifying foundation / Inter level / Final in CA/ICSI/CMA / etc.,	1

#### 8.7 Sports and Games

The Student can earn extra credit based on their Achievement in sports as given below:

Qualification	Credits
Achievement in University/ State / National/ International	1

#### 8.8 Online Courses

Pass in any one of the online courses

Qualification	Credit
SWAYAM/NPTEL/Spoken Tutorial etc.,	1





## 8.9 Publications / Conference Presentations (Oral/Poster)/ Awards

Qualification	Credit
Research Publications in Journals/ oral/poster presentation in Conference	1

## 8.10 Innovation / Incubation / Patent / Sponsored Projects / Consultancy

Qualification	Credit
Development of model/ Products /Prototype /Process/App/Registration of Patents/ Copyrights/Trademarks/Sponsored Projects /Consultancy	1

## 8.11 Representation

Qualification	Credit
State / National level celebrations such as Independence day, Republic day Parade, National Integration camp etc.,	1



Course Code	Course Name	Category	L	T	P	Credit
211TL1A1TA	தமிழ்த் தாள் - I	மொழி- I	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand .

- மொழிப்பாடங்களின் வாயிலாக தமிழரின் பண்பாடு , பகுத்தறிவு ஆகியவற்றை அறியச் செய்தல்
- கலை மற்றும் மரபுகளை அறியச் செய்தல்
- மாணவர்களின் படைப்பாக்கத்திறன்களை ஊக்குவித்தல்

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	வாழ்க்கைத்திறன்கள் (Life Skills) – மாணவனின் செயலாக்கத்திறனை ஊக்குவித்தல்	K1,K2,K3
CO2	மதிப்புக்கல்வி (Attitude and Value education)	K2,K4
CO3	பாட இணைச் செயல்பாடுகள் (Co-curricular activities)	K2,K3,K4
CO4	சூழலியல் ஆக்கம் (Ecology)	K4
CO5	மொழி அறிவு (Tamil knowledge)	K5, K6

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong

M Medium

L Low





211TL1A1TA	தமிழ்த்தாள் - I	SEMESTER I
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Total Credits: 03

Total Instruction Hours: 60 h

## Syllabus

Unit I மறுமலர்ச்சிக் கவிதைகள் 12 h

1. உயிர் பெற்ற தமிழர் பாட்டு - பாரதியார்
2. படி - பாரதிதாசன்
3. போராடப் புறப்பட்டோம் - தமிழ் ஒளி
4. தமிழ்க் கொலை புரியாதீர் - புலவர் குழந்தை
5. திரைத்தமிழ்
  - அ) சும்மா கிடந்த நிலத்தை எனத்தொடங்கும் பாடல் -
  - பட்டுக்கோட்டை கல்யாண சுந்தரனார்
  - ஆ) சமரசம் உலாவும் இடமும் எனத்தொடங்கும் பாடல் - மருதகாசி
  - இ) உன்னை அறிந்தால் எனத்தொடங்கும் பாடல் - கண்ணதாசன்

Unit II புதுக்கவிதைகள் 12 h

1. கடமையைச் செய் - மீரா
2. அம்மாவின் பொய்கள் - ஞானக்கூத்தன்
3. செருப்புடன் ஒரு பேட்டி - மு.மேத்தா
4. ஒரு சிங்கவால் குரங்கின் மரணம் - சிற்பி
5. கடல்கோள் 2004 - முத்தமிழ் விரும்பி
6. கரிக்கிறது தாய்ப்பால் - ஆரூர் தமிழ்நாடன்
7. ஐந்தாம் வகுப்பு 'அ' பிரிவு - நா. முத்துக்குமார்
8. ஹைகூ கவிதைகள் - 15 கவிதைகள்

Unit III பெண்ணியம் 08 h

1. ஒரு கதவும் கொஞ்சம் கள்ளிப்பாலும் - தாமரை
2. நீரில் அலையும் முகம் - அ. வெண்ணிலா
3. தொட்டிச் செடி - இளம்பிறை
4. ஏனிந்த வித்தியாசங்கள் - மல்லிகா



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## Unit IV சிறுகதைகள்

15 h

- |                        |                    |
|------------------------|--------------------|
| 1. வேப்பமரம்           | - ந. பிச்சமூர்த்தி |
| 2. அகல்யை              | - புதுமைப்பித்தன்  |
| 3. ஒருபிடி சோறு        | - ஜெயகாந்தன்       |
| 4. காய்ச்சமரம்         | - கி. ராஜநாராயணன்  |
| 5. நிராசை              | - பாமா             |
| 6. குதிரை மசால் தாத்தா | - சு. வேணுகோபால்   |

## Unit V இலக்கியவரலாறு, இலக்கணம் மற்றும் பயிற்சிப் பகுதி

13 h

### அ. இலக்கிய வரலாறு

1. மறுமலர்ச்சிக் கவிஞர்களின் தமிழ்ப்பணிகள்
2. புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்
3. சிறுகதையின் தோற்றமும் வளர்ச்சியும்

### ஆ. இலக்கணம்

1. வல்லினம் மிகும், மிகா இடங்கள் (ஒற்றுப்பிழை நீக்கி எழுதுதல்)
2. ர,ற ,ல, ழ, ள ,ண, ந,ன, வேறுபாடு (ஒலிப்பு நெறி, சொற்பொருள் வேறுபாடு அறிதல்)

### இ. படைப்பாக்கப் பயிற்சி

1. கவிதை, சிறுகதை எழுதுதல்

## Text Books

- 1 செய்யுள் மற்றும் உரைநடைத் திரட்டு . 2021. தொகுப்பு : தமிழ்த் துறை , டாக்டர் என். ஜி.பி. கலை மற்றும் அறிவியல் கல்லூரி. நியூ செஞ்சுரி புக் ஹவுஸ்(பி)லிட். சென்னை.

## References

- 1 பேராசிரியர் முனைவர் பாக்கியமேரி. இலக்கணம் இலக்கிய வரலாறு மொழித்திறன். முதல் பதிப்பு 2013 . பூவேந்தன் பதிப்பகம். சென்னை
- 2 தமிழண்ணல் . புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு . பதினாறாம் பதிப்பு 2000 மீனாட்சி புத்தக நிலையம். மதுரை.
- 3 பேராசிரியர் புலவர் இளவரசு ,சோம. புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு. எட்டாம் பதிப்பு ஜூலை 2012.மணிவாசகர் பதிப்பகம்.சென்னை
- 4 தமிழ் இணையக் கல்விக்கழகம். <<http://www.tamilvu.org/>>



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APPROVED		
B.S- 11th	AC - 11th	GB - 15th
17.05.2021	09.08.2021	17.08.2021



Course Code	Course Name	Category	L	T	P	Credit
201TL1A1HA	HINDI-I	Language 1	4	1	-	03

### PREAMBLE

This course has been designed for students to learn and understand

- the writing ability and develop reading skill.
- various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

communicate Hindi

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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201TL1A1HA	HINDI-I	SEMESTER I
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Total Credits: 03

Total Instruction Hours: 60 h

## Syllabus

Unit I	गद्य – नूतन गद्य संग्रह (जय प्रकाश)	12 h
	पाठ 1- रजिया	
	पाठ 2- मक्रील	
	पाठ 3- बहता पानी निर्मला	
	पाठ 4- राष्ट्रपिता महात्मा गाँधी	
Unit II	कहानी कुंज- डॉ वी.पी. 'अमिताभ'	12 h
	कहानी कुंज- डॉ वी.पी. 'अमिताभ' (पाठ 1-4)	
Unit III	व्याकरण	12 h
	शब्द विचार ( संज्ञा, सर्वनाम, कारक, विशेषण)	
Unit IV	अनुच्छेद लेखन	12 h
	अनुच्छेद लेखन	
Unit V	अनुवाद	12 h
	अभ्यास-III (केवल अंग्रेजी से हिन्दी में)	

## Text Books

- 1 प्रकाशक: सुमित्र प्रकाशन 204 लीला अपार्टमेंट्स, 15 हेस्टिंग्स रोड अशोक नगर इलाहाबाद-211001 (Unit - I)
- 2 प्रकाशक: गोविन्द प्रकाशन सदर बाजार, मथुरा उत्तर प्रदेश – 281001 (Unit-II)
- 3 पुस्तक: व्याकरण प्रदिप – रामदेव प्रकाशक: हिन्दी भवन 36 टेंगोर नगर इलाहाबाद – 211024 (Unit-III)
- 4 पुस्तक: व्याकरण प्रदिप – रामदेव प्रकाशक: हिन्दी भवन 36 इलाहाबाद-211024 (Unit-IV)
- 5 (पाठ 1 to 10) प्रकाशक: दक्षिण भारत प्रचार सभा चेन्नई -17 (Unit - V)



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BoS- 11th	AC- 11th	GB- 15th
17.05.2021	09.08.2021	17.08.2021



Course Code	Course Name	Category	L	T	P	Credit
201TL1A1MA	MALAYALAM	Language - I	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- develop the writing ability and develop reading skill.
- various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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201TL1A1MA	MALAYALAM - I	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 60 h

## Syllabus

Unit I	Novel	12 h
	1. Alahayude penmakkal	
Unit II	Novel	12 h
	1. Alahayude penmakkal	
Unit III	Short Story	14 h
	2. Nalinakanthi	
Unit IV	Short Story	10 h
	2. Nalinakanthi	
Unit V		12 h
	Composition & Translation	

## Text Books

- 1 Alahayude penmakkal (NOVEL) By Sara Joseph Published by Current books Thrissur.
- 2 Nalinakanthi (Short story) By T.Padmanabhan Published by DC.Books Kottayam
- 3 Expansion of ideas, General Essay And Translation.

## References

- 1 Malayala Novel Sahithyam
- 2 Malayala cherukatha Innale Innu.

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Course Code	Course Name	Category	L	T	P	Credit
201TL1A1FA	FRENCH- I	Language - I	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- Competence in General Communication Skills – Oral + Written – Comprehension & Expression.
- the Culture, life style and the civilization aspects of the French people as well as of France.
- Competency in translating simple French sentences into English and vice versa.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents.	K1
CO2	learn the adjectives and the classroom environment in France.	K2
CO3	Learn the Plural, Articles and the Hobbies.	K3
CO4	learn the Cultural Activity in France.	K3
CO5	learn the Sentiments, life style of the French people and the usage of the conditional tense.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

201TL1A1FA	FRENCH- I	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 60 h

## Syllabus

## Unit I Salut I Page 10

12 h

Objectifs de Communication	Tâche	Activités de réception et de production orale
<ul style="list-style-type: none"> <li>• Saluer</li> <li>• Enter en contact avec quelqu'un.</li> <li>• Se presenter.</li> <li>• S'excuser</li> </ul>	En cours de cuisine, premiers contacts avec les members d'un groupe	<ul style="list-style-type: none"> <li>• Comprendre des personnes qui se saluent.</li> <li>• Échanger pour entrer en contact, se présenter, saluer, s'excuser.</li> <li>• Communiquer avec <i>tu</i> ou <i>vous</i>.</li> <li>• Comprendre les consignes de classe</li> <li>• Épeler son nom et son prénom.</li> </ul> <p>Computer jusqu'à 10.</p>

## Unit II Enchanté I Page 20

12 h

Objectifs de Communication	Tâche	Activités de réception et de production orale
<ul style="list-style-type: none"> <li>• Demander de se presenter.</li> <li>• Présenter quelqu'un.</li> </ul>	Dans la classe de français, se presenter et remplir une fiche pour le professeur.	<ul style="list-style-type: none"> <li>• Comprendre les informations essentielles dans un échange en milieu professionnel.</li> <li>• Échanger pour se presenter et présenter quelqu'un.</li> </ul>

## Unit III J'adore I Page 30

12 h

Objectifs de Communication	Tâche	Activités de réception et de production orale
<ul style="list-style-type: none"> <li>• Exprimer ses goûts.</li> </ul>	Dans un café, participer à une soirée de rencontres	<ul style="list-style-type: none"> <li>• Dans une soirée de rencontres rapid comprendre des personnes qui échantent sur elles et sur leurs goût</li> </ul>



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	rapides et remplir de tâches d'appréciation.	qui parler des goûts de quelqu'un d'autre.
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## Unit IV J'adore I Page 30

14 h

Objectifs de Communication	Tâche	Activités de réception et de production orale
<ul style="list-style-type: none"> <li>Présenter quelqu'un</li> </ul>	Dans un café, participer à une soirée de rencontres rapides et remplir de tâches d'appréciation	<ul style="list-style-type: none"> <li>Exprimer ses goûts.</li> <li>Comprendre une demande laissée sur un répondeur téléphonique.</li> <li>Parler de ses projets de week-end.</li> </ul>
Autoévaluation du module I Page 40 – Préparation au DELF A1 page 42		

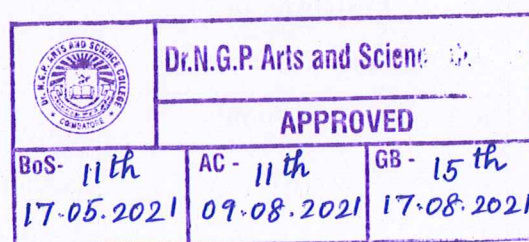
## Unit V Tu veux bien? Page 46

10 h

Objectifs de Communication	Tâche	Activités de réception et de production orale
<ul style="list-style-type: none"> <li>Demander à quelqu'un de faire quelque chose.</li> <li>Demander poliment.</li> <li>Parler d'actions passées.</li> </ul>	Organiser un programme d'activités pour accueillir une personne importante.	<ul style="list-style-type: none"> <li>Comprendre une personne demande un service à quelqu'un.</li> <li>Demander à quelqu'un de faire quelque chose.</li> <li>Imaginer et raconter au passé à partir de situations dessinées.</li> </ul>

## Text Books

- 1 Regine Merieux, Yves Loiseau, LATITUDES 1(Methode de Français), Goyal Publisher & Distributors Pvt.Ltd., 86 UB Jawahar Nagar (Kamala Nagar), Delhi-7 Les Editions Dider, Paris, 2008- Imprime en Roumanie par Canale en Janvier 2012.



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Course Code	Course Name	Category	L	T	P	Credit
211EL1A1EA	PROFESSIONAL ENGLISH - I	Language - II	4	0	1	3

### PREAMBLE

This course has been designed for students to learn and understand

- To experience the effect of dialogue, the brilliance of imagery and the magnificence of varied genre
- To strengthen the student's English vocabulary and understanding of English sentence structure
- To communicate effectively and acquire knowledge on the transactional concept of English language

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Extend interest in and appreciation of the works of eminent writers from various literatures	K2
CO2	Interpret the genres in literature through the master works of great visionaries	K3
CO3	Perceive the language gaps through a clear model of the grammatical structure	K5
CO4	Analyze the concepts of texts in the course of different lessons which are realistic and discursive in nature	K4
CO5	Value the integral concepts of English grammar necessarily required in their linguistic competence	K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	S	S	S
CO3	M	S	S	S	M
CO4	S	S	M	S	M
CO5	S	S	S	S	M



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**M**

**Medium**

**L**

**Low**

B.Sc. Biotechnology (Students admitted during the AY 2021-22)



<b>211EL1A1EA</b>	<b>PROFESSIONAL ENGLISH - I</b>	<b>SEMESTER I</b>
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**Total Credits: 3**

**Total Instruction Hours: 60 h**

### **Syllabus**

**Unit I**      Genre Studies - I 10 h

The Road Not Taken – Robert Frost

All the World's a Stage – William Shakespeare

Whitewashing the Fence – Mark Twain

The Face of Judas Iscariot - Bonnie Chamberlain

Soul Gone Home – Langston Hughes

**Unit II**      Genre Studies - II 11 h

Ode on a Grecian Urn – John Keats

Mending Wall – Robert Frost

My Early Days – Dr. A.P.J. Abdul Kalam

Nightfall – Isaac Asimov

A Kind of Justice – Margret Atwood

**Unit III**      Grammar - I 14 h

Parts of Speech

Articles and Prepositions

Subject Verb Agreement

Degrees of Comparison

Sequence of Tenses

**Unit IV**      Genre Studies - III 11 h

On his Blindness - John Milton

Small - Scale Reflections on a Great House – A.K. Ramanujan

On Prayer – Khalil Gibran

The Garden Party – Katherine Mansfield

The Tell - Tale Heart – Edgar Allen Poe



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**Unit V Grammar - II**

14 h

If Conditionals

Modal Auxiliary Verbs

Question Types/Tags

Voice


Direct and Indirect Speech

**Text Books**

- 1 Prabha, Vithya. R and S. Nithya Devi. 2019. Sparkle: English Textbook for First Year. McGraw Hill Education, Chennai.
- 2 Wren and Martin. 2006. High School English Grammar and Composition. S. Chand Publishing, New Delhi.

**References**

- 1 Bajwa and Kaushik. 2010. Springboard to Success- Workbook for Developing English and Employability Skills. Orient Black Swan, Chennai
- 2 Syamala. V. 2002. Effective English Communication for You. Emerald Publishers, Chennai.
- 3 Krishnaswamy. N, Lalitha Krishnaswamy & B.S. Valke. 2015. Eco English, Learning English through Environment Issues. An Integrated, Interactive Anthology. Bloomsbury Publications, New Delhi.
- 4 Krishnaswamy. N. 2000. Modern English: A Book of Grammar, Usage And Composition. Macmillan, New Delhi.

		
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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



Course Code	Course Name	Category	L	T	P	Credit
193BT1A1CA	CELL BIOLOGY	CORE	4	1		3

### PREAMBLE

This course has been designed for students to learn and understand

- The basic components and functions of cell organelles.
- The cell signaling, cycle, progression and its regulation
- The pathological progressions of a cell

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the process of cell architecture and composition	K1, K2
CO2	Paraphrase the membrane organization for nutrient uptake	K1, K2
CO3	Report the mode of transport relating to inter and intracellular mechanisms	K2, K3
CO4	Sketch signaling events within cells	K2, K3
CO5	Illustrate the cell cycle events and pathological progressions documentation, inspection and certification	K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	M	M	S	M

**S Strong**

**M Medium**

**L Low**



193BT1A1CA	CELL BIOLOGY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Cell Overview and Organelles 13 h

History - cell theory - scope - types and shapes - organization of prokaryotic and eukaryotic cell and their differences. Cytoskeleton - microtubules. Nucleus, endoplasmic reticulum (rough and smooth), golgi apparatus, mitochondria, ribosomes, chromosome, chloroplast, lysosome, peroxisome.

#### Unit II Cell Organization 12 h

Cell membrane - structure and function, transport of nutrients and ions across the membranes. Diversity of plasma membranes (Trilamellar, bimolecular leaflet, lattice, micellar, fluid mosaic model). Desmosomes, plasmodesmata. Cell junctions - adherent, gap and tight junctions.

#### Unit III Cell Transport 10 h

Membrane transport types. General classes of transport systems- uniport, symport, antiport. Diffusion- passive and facilitated. Active transport- primary and secondary. The P-type ATPases ( $\text{Na}^+\text{K}^+ \text{-ATPase}$ ), ion channels (ligand- gated and voltage-gated).

#### Unit IV Cell Signaling 12 h

Intracellular signaling - categories of signaling - types of signal receptors - Receptors of special importance - Extra Cellular Matrix- Cell Interactions. Endocrine, paracrine, autocrine signaling and juxtacrine signalling .

#### Unit V Cell Cycle 13 h

Cell cycle - Mitosis - meiosis and their significance. Cell Ageing - mechanism - theories (Free radical theory and somatic mutation theory). Cell death - necrosis, apoptosis. Difference between necrosis and apoptosis. Mechanism of apoptosis. Characteristics of cancer cell. Tumor cells - Stages of progression.






### Text Books

- 1 Rastogi, C.S., 2005, Cell Biology, 3rd edition, New Age International Publishers, India
- 2 Islam, A. 2011, Text Book of Cell Biology, 2nd edition, Books and Allied (P) Ltd. , India

### References

- 1 Alberts, B., 1998, Essential Cell Biology, 1st edition. Garland Publishers, USA
- 2 De Roberties, D., 2003, Cell and Molecular Biology, 8th edition, EDP Lippincott Williams, USA
- 3 Karp, G. , 2002, Cell and Molecular Biology, 3rd edition, John Wiley Sons, USA
- 4 Lodish, H. & Baltimore D, 1994, Molecular Cell Biology, 2nd edition, American Scientific Books, USA

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A1CB	BIODIVERSITY	CORE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The diversity and conservation of organisms.
- The importance of diversity.
- The ethics involved in conservation.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify the nature, concept and definition of Biodiversity, conservation strategies.	K1, K2
CO2	Explain the Global patterns of Biodiversity	K1, K2
CO3	Discuss biodiversity & major biomes of world	K1, K2
CO4	Demonstrate biodiversity for sustainable development	K1, K2, K3
CO5	Analyze the ethics involved in conservation	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	M	S	S	S	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



193BT1A1CB	BIODIVERSITY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Biodiversity Concepts and Definition 13 h

Scope and Constraints of Biodiversity Science, Composition and Scales of biodiversity. Biodiversity and its types : Genetic Diversity, Species/Organismal Diversity, Ecological/Ecosystem Diversity, Landscape/Pattern Diversity, Agrobiodiversity, Bicultural Diversity and Urban Biodiversity

#### Unit II Global Patterns of Biodiversity 12 h

Cataloging and Discovering Species, Geographical Patterns of Species Richness, Biogeography, Importance of Distribution Patterns (Local Endemics, Sparsely Distributed Species, Migratory Species), GAP Analysis. Species & individual in the ecosystem - a) Habitat & niche b) Ecological equivalence c) Biological clock Basic behavioral patterns

#### Unit III Biodiversity Threats and Conservation 12 h

Specific flora & fauna. Biodiversity & Conservation – Overexploitation threatening living species, rare and endangered species, International Trade. Threats to Biodiversity - Animals threatened by International trade, Problems in Controlling International Trade (Enforcement, Reservations, Illegal Trade), Free Trade & the Environment, Free Trade & Conservation, etc., In situ and ex situ conservation.

#### Unit IV Community Ecology 13 h

Interspecific interactions - Interspecific Competition, Host-Parasite interactions, Predator-prey interactions, Plant herbivore interaction. Community ecology - Structure and function of communities, Functional aspects of communities, Stability and change in communities Regulation of communities - Role of species diversity, Role of predators, Role of competition, Role of nutrients, other factors

#### Unit V Biodiversity for Sustainable Development 10 h

Sustainable management of biodiversity: International and regional policies. Biodiversity Act, National Biodiversity Board and other organizations worldwide. International conventions and treaties on conservation. Biodiversity Institutes in India: Zoological Survey of India, Botanical Survey of India, Forest Research Institute, Central Marine Fisheries Research Institute. Ethics of conservation: Legal, Ethical and Conservation issues related to uses of biodiversity, Global Conservation



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

## Text Books

- 1 Krishnamurthy K V., 2003, Textbook of Biodiversity, 1st edition, Science Publisher, India.
- 2 Narendran T. C., 2006, An Introduction to Taxonomy, Zoological Survey of India, Kolkata.

## References

- 1 Negi S.S, 1993, Biodiversity and its Conservation in India, 1st edition, Indus Publishing Co., India
- 2 Jeffries, M.J., 2006, Biodiversity and Conservation, 1st edition, Routledge, UK.
- 3 Jeffery M.I. et al., 2008, Biodiversity Conservation, Law and Livelihoods. 1st edition, Cambridge University Press, UK
- 4 Singh G, 2008, Plant Systematics: Theory and Practice, Oxford & IBH Publishing Co. Pvt. Ltd., India.

		
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193BT1A1CP	CELL BIOLOGY AND BIODIVERSITY	SEMESTER I
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Total Credits: 2  
Total Instructions Hours: 48 h

S.No	List of Experiments
1	Demonstration of Basic Laboratory Practices and instrument handling*
2	Calculations of Molarity, Normality and Percentage Solution
3	Preparation of buffer in different pH - Phosphate, Acetate, Tris buffer
4	Preparation of equilibrated phenol
5	Simple staining of Bacteria and observation under stereomicroscope*
6	Microscopic observation of Monocot and Dicot Leaf, Root and Stem section
7	Staining of plant cells – Onion epidermal cells
8	Staining of starch granules
9	Cell counting using Haemocytometer
10	Blood smear preparation for blood cell identification
11	Mitotic preparation from onion root tip
12	Preparation of Herbaria – Five families (1 Plant from each family) with Authentication from authorized agencies*


**Note:** Any 10 experiments from the above will be carried out

\* Indicates DBT STAR College Scheme Experiment



## References

- 1 Becker JM, Caldwell, G.A. and Zachgo, A., 2007, Biotechnology- A laboratory Cours, 2nd edition, Academic Press, USA
- 2 Sambrook, J., Green, M.R., 2012, Molecular Cloning: A Laboratory Manual, 4th edition, Cold Spring Harbor, USA
- 3 Davey, J. and Lord, M. 2003, Essential Cell Biology Volume 1: Practical Approach, 1st edition, OUP Oxford, UK
- 4 Lindenmayer D. and Burgman, M., 2005, Practical Conservation Biology, 5th edition, CSIRO Publishing, Australia

		
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Course Code	Course Name	Category	L	T	P	Credit
192CE1A1IB	CHEMISTRY FOR BIOLOGISTS	IDC	4	-		4

### PREAMBLE

This course has been designed for students to learn and understand

- The basic concepts of chemical bonding in molecules
- The essentials of organic chemistry and coordination chemistry. Enable to differentiate the organic molecule configurations.
- The fundamentals of solution concepts and to know the kinetics of chemical reactions.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	State the basic theories in coordination chemistry and to name the inorganic compounds	K1
CO2	Classify bonding in molecules, crystals structures and evaluate their bonding characteristics	K2
CO3	Apply concepts of bonding in organic molecules & their displacement reactions with mechanism	K2, K3
CO4	Assess the preparation of laboratory solutions	K3
CO5	Categorize the spontaneity of the reaction, the nature of catalyst and reaction pathway.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	S	S
CO5	M	M	S	S	S



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**Strong**  
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**M**

**Medium**

**L**

**Low**

B.Sc. Biotechnology (Students admitted during the AY 2021-22)

192CE1A1IB	CHEMISTRY FOR BIOLOGISTS	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Coordination Chemistry and Fertilizers 09 h

Nomenclature, Theories of Werner, Sidgwick, Pauling, Chelation examples, Haemoglobin, Chlorophyll. Applications in qualitative and quantitative analysis of EDTA.

Fertilizers:

Urea, ammonium sulphate, ammonium Nitrate, Potassium Nitrate, NPK fertilizer, Triple Superphosphate, Pollution of air, Water and Soil-sources, remedies

#### Unit II Chemical Bonding 10 h

Molecular Orbital Theory- bonding, anti-bonding and non-bonding orbitals. MO-configuration of  $H_2$ ,  $N_2$ ,  $O_2$ ,  $F_2$ - bond order- diamagnetism and paramagnetism. Ionic Bond: Nature of ionic bond, structure of NaCl and CsCl, factors influencing the formation of ionic bond.

Covalent Bond: Nature of covalent bond, structure of  $CH_4$ ,  $NH_3$ ,  $H_2O$ , shapes of  $BeCl_2$ ,  $BF_3$ , based on VSEPR theory and hybridization.

#### Unit III Basic Organic Chemistry 10 h

Electron displacement effect in organic compounds - Inductive effect - Electromeric effect - Resonance effect, Hyperconjugation and Steric effect.

Isomerism, Symmetry of elements (Plane, Centre and Axis of symmetry), Molecules with one chiral carbon and two adjacent chiral carbons -Optical isomerism of lactic acid and tartaric acid, Enantiomers, Diastereomers - Separation of racemic mixture, Geometrical isomerism (maleic and fumaric acid). R/S and E/Z configuration assignments for simple molecules.

#### Unit IV Solutions 10 h

Normality, molarity, molality, mole fraction, mole concept.

Primary and secondary standards - preparation of standard solutions. Principle of Volumetric analysis (with simple problems).

Indicators - Theory of indicators- Acid base and quinonoid.  
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Strong and weak acids and bases - Ionic product of water- pH, pKa, pKb, Buffer solution, pH and pOH simple calculations.

### Unit V Chemical Kinetics and Catalysis

09 h

Rate of reaction, rate law, order, molecularity, first order rate law, half life period of first order equation, pseudo first order reaction, zero and second order reactions.

Derivation of rate expression for I and II order kinetics.


Catalysis – homogenous, heterogeneous and enzyme catalysis (definition only), enzymes used in industry, characteristics of catalytic reactions

### Text Books

- 1 Madan R.D., 2014, Modern Inorganic Chemistry, 2nd edition, S. Chand & Company, India
- 2 Puri S., and Pathania P., 2017, Principles of Physical Chemistry, 47th Edition, Vishal Publishing Company, India

### References

- 1 Bahl B.S., 2016. Organic Chemistry, 22nd Edition, S. Chand & Company, India
- 2 Jain, M.K and Sharma C.S, 2007, Organic Chemistry, 3rd edition, Shoban Lal Nayin Chand, India
- 3 Gopalan R. 2004. Elements of Analytical Chemistry, 2nd edition Chand & Sons, India.
- 4 Soni, P.L. and Katyal, M, 2007, Text book of inorganic chemistry, 20th edition, Chand and Sons, India

		
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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

Course Code	Course Name	Category	L	T	P	Credit
193MB1A1AA	VALUE EDUCATION- ENVIRONMENTAL STUDIES	AECC	2	-	-	2

### PREAMBLE

This course has been designed for students to learn and understand

- Multi disciplinary aspects of Environmental studies
- Importance to conserve the Biodiversity
- Causes of Pollution and its control

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the importance of natural resources in order to conserve for the future.	K2
CO2	inculcate the knowledge on structure, function and energy flow in the Eco system.	K3
CO3	impart knowledge on Biodiversity and its conservation.	K3
CO4	create awareness on effects, causes and control of air, water, soil and noise pollution etc.	K2,K3
CO5	build awareness about sustainable development and Environmental protection	K2,K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	M	M	M	M	M
CO4	M	M	M	M	M
CO5	M	M	M	M	M



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**M**

**Medium**

**L**

**Low**

B.Sc. Biotechnology (Students admitted during the AY 2021-22)



193MB1A1AA	VALUE EDUCATION- ENVIRONMENTAL STUDIES	SEMESTER I
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Total Credits: 2

Total Instruction Hours: 24 h

### Syllabus

#### Unit I Introduction to Environmental studies& Ecosystems 4 h

Multidisciplinary nature of environmental studies; components of environment – atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development. What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

#### Unit II Natural Resources: Renewable and Non-renewable Resources 5 h

Land Resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and overexploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Heating of earth and circulation of air; air mass formation and precipitation. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

#### Unit III Biodiversity and Conservation 5 h

Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

#### Unit IV Environmental Pollution, Environmental Policies & Practices 5 h

Environmental pollution : types, causes, effects and controls; Air, water, soil, chemical and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies. Climate change, global warming, ozone layer depletion, acid rain and effects on human communities and agriculture. Environment Laws : Environment Protection Act, Air (Prevention & Control of Pollution) Act; Water (Prevention and





control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC). Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context.

## Unit V Human Communities and the Environment & Field Work 5 h

Human population and growth: Impacts on environment, human health and welfares. Carbon foot-print. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquakes, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Visit to an area to document environmental assets; river/forest/flora/fauna, etc. Visit to a local polluted site – Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

### Text Books

- 1 Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt
- 2 Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
- 3 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 4 Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
- 5 Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
- 6 Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
- 7 McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 296-4). Zed Books.
- 8 McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
- 9 Odum, E.P., Odum, h.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.



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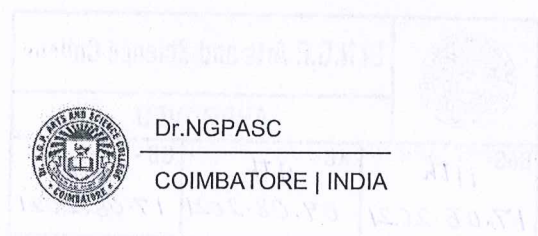
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## References

- 1 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
- 2 Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
- 3 Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
- 4 Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.

		
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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
Part - I										
191TL1A2TA	Language - I	Tamil-II	4	1	-	3	25	75	100	3
201TL1A2HA		Hindi-II								
201TL1A2MA		Malayalam-II								
201TL1A2FA		French - II								
Part - II										
211EL1A2EA	Language - II	Professional English - II	4	-	1	3	25	75	100	3
Part - III										
193BT1A2CA	Core III	Molecular Biology	4	1	-	3	25	75	100	3
193BT1A2CB	Core IV	Microbiology	4	1	-	3	25	75	100	3
193BT1A2CP	Core Practical II	Molecular Biology & Microbiology	-	-	4	5	40	60	100	2
194CT1A2IC	IDC - II	Computers for Biologists	4	-	-	3	25	75	100	4
Part - IV										
196MB1A2AA	AECC - II	Human Rights	2	-	-	2	-	50	50	2
Total			22	3	5	-	-	-	650	20





Course Code	Course Name	Category	L	T	P	Credit
191TL1A2TA	பகுதி-1: தமிழ் - தாள்- II	மொழி	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- மொழிப் பாடங்களின் வாயிலாகத் தமிழரின் பண்பாடு, பகுத்தறிவு ஆகியவற்றை அறியச் செய்தல்
- கலை மற்றும் மரபுகளை அறியச் செய்தல்
- மாணவர்களின் படைப்பாக்கத் திறன்களை ஊக்குவித்தல்

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	வாழ்க்கைத்திறன்கள் (Life Skills) – மாணவனின் செயலாக்கத்திறனை ஊக்குவித்தல்	K1,K2,K3
CO2	மதிப்புக்கல்வி (Attitude and Value education)	K2,K4
CO3	பாட இணைச் செயல்பாடுகள் (Co-curricular activities)	K2,K3,K4
CO4	சூழலியல் ஆக்கம் (Ecology)	K4
CO5	மொழி அறிவு (Tamil knowledge)	K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong

M Medium

L Low



191TL1A2TA	பகுதி-1: தமிழ் - தாள்- II	SEMESTER II
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Total Credits: 3  
Total Instruction Hours: 60 h

### Syllabus

#### Unit I அற இலக்கியம்

12 h

##### 1. திருக்குறள்

அ.அறன் வலியுறுத்தல் (அ. எண்: 04)

ஆ.நட்பாராய்தல் (அ. எண்: 80)

இ.சான்றாண்மை (அ. எண்: 99)

ஈ.குறிப்பறிதல் (அ. எண்: 110)

##### 2. மூதுரை - ஓளவையார் (10 பாடல்கள் - 6,7,9,10,14,16,17,23,26,30)

#### Unit II அற இலக்கியம்

10 h

1. நாலடியார் - அறிவுடைமை

2.பழமொழி நானூறு - வீட்டு நெறி

3. கார்நாற்பது - தோழி பருவங்காட்டி தலைமகளை வற்புறுத்திய பாடல்கள்  
(1முதல் - 18பாடல்கள்)

#### Unit III உரைநடை

10 h

1. பெற்றோர்ப் பேணல் - திரு.வி.க.

2. உள்ளம் குளிர்ந்தது - மு.வரதராசனார்

3. சங்கநெறிகள் - வ.சுப.மாணிக்கம்

#### Unit IV உரைநடை

13 h

1.பெரியார் உணர்த்தும்  
சுயமரியாதையும் சமதர்மமும் - வே. ஆனைமுத்து

2. வீரவணக்கம் - கைலாசபதி

3.மொழியும்நிலமும் - எஸ். ராமகிருஷ்ணன்



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அ.இலக்கிய வரலாறு

1. பதினெண் கீழ்க்கணக்கு நூல்கள்
2. தமிழ் உரைநடையின் தோற்றமும் வளர்ச்சியும்

ஆ. இலக்கணம்

1. வழு, வழுவமைதி, வழாநிலை

இ. பயிற்சிப் பகுதி

1. நூல் மதிப்பீடு மற்றும் திரைக்கதை திறனாய்வு
2. தன்விவரக் குறிப்பு எழுதுதல்


**Note :** பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

### Text Books

- 1 தொகுப்பு: தமிழ்த்துறை, டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி (தன்னாட்சி) செய்யுள் மற்றும் உரைநடைத் திரட்டு. (முதல்பதிப்பு.) சென்னை: நியூ செஞ்சுரி பக்ஹவுஸ் (பி) லிட்.

### References

- 1 பேராசிரியர் புலவர் இளவரசு, சோம. (ஜூலை2012). தமிழ் இலக்கிய வரலாறு. (எட்டாம் பதிப்பு) சென்னை: மணிவாசகர் பதிப்பகம்.
- 2 பேராசிரியர் முனைவர் பாக்கியமேரி (2013). இலக்கணம் இலக்கிய வரலாறு மொழித்திறன். (முதல் பதிப்பு) சென்னை பூவேந்தன் பதிப்பகம்.
- 3 தமிழ் இணையக் கல்விக்கழகம் <<http://www.tamilvu.org/>>

		
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Course Code	Course Name	Category	L	T	P	Credit
201TL1A2HA	HINDI -II	LANGUAGE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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201TL1A2HA	HINDI -II	SEMESTER II
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Total Credits: 03

Total Instruction Hours: 60 h

## Syllabus

## Unit I

12 h

आधुनिक पद्य – शबरी (श्री नरेश मेहता)

प्रकाशक: लोकभारती प्रकाशन

पहली मंजिल, दरबारी बिल्डिंग,

महात्मा गाँधी मार्ग, इलाहाबाद-211001

## Unit II

12 h

उपन्यास: सेवासदन-प्रेमचन्द

प्रकाशक: सुमित्र प्रकाशन

204 लीला अपार्टमेंट्स, 15 हेस्टिंग्स रोड

अशोक नगर इलाहाबाद-211001

## Unit III

12 h

कहानी-किरीट- डा उषा पाठक / डा अचला पाण्डेय

पाठ 1. उसने कहा था

पाठ 2. कफ़न,

पाठ 3. चीफ़ की दावत

प्रकाशक: राधाकृष्ण प्रकाशन दिल्ली

## Unit IV

12 h

पत्र लेखन: (औपचारिक या अनौपचारिक)

पुस्तक: व्याकरण प्रदिप – रामदेव

प्रकाशक: हिन्दी भवन 36 इलाहाबाद-211024


## Unit V

12 h

अनुवाद अभ्यास-III (केवल हिन्दी से अंग्रेजी में)

(पाठ 1 to 10)

प्रकाशक: दक्षिण भारत प्रचार सभा चेन्नई -17

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Course Code	Course Name	Category	L	T	P	Credit
201TL1A2MA	MALAYALAM - II	LANGUAGE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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201TL1A2MA	MALAYALAM -II	SEMESTER II
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Total Credits: 3


Total Instruction Hours: 60 h

### Syllabus

Unit I	12 h
Travelogue	
Unit II Novel	12 h
Travelogue	
Unit III	14 h
Travelogue	
Unit IV	10 h
Autobiography	
Unit V	12 h
Autobiography	

### Text Books

- 1 Dubai Puzha (Travelogue) By K.Krishna Das, Published by Green books Thrissur.
- 2 Vazhithirivukal (Autobiography) By Dr.APJ Abdul Kalam Published by DC.Books Kottayam

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Course Code	Course Name	Category	L	T	P	Credit
201TL1A2FA	FRENCH -II	LANGUAGE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To Acquire Competence in General Communication Skills – Oral + Written – Comprehension & Expression.
- To Introduce the Culture, life style and the civilization aspects of the French people as well as of France.
- To help the students to acquire Competency in translating simple French sentences into English and vice versa.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents.	K1
CO2	To learn the adjectives and the classroom environment in France.	K2
CO3	Learn the Plural, Articles and the Hobbies.	K3
CO4	To learn the Cultural Activity in France.	K3
CO5	To learn the Sentiments, life style of the French people and the usage of the conditional tense.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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201TL1A2FA	FRENCH -II	SEMESTER II
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Total Credits: 3

Total Instruction Hours: 60 h

## Syllabus

## Unit I

12 h

<ul style="list-style-type: none"> <li>Proposer, accepter, refuser une invitation.</li> <li>Indiquer la date.</li> </ul>	Organiser une soirée au cinéma avec des amis, par téléphone et par courriel.	<ul style="list-style-type: none"> <li>Comprendre un message d'invitation sur un répondeur téléphonique.</li> <li>Inviter quelqu'un à accepter ou refuser l'invitation.</li> </ul>
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## Unit II

12 h

<ul style="list-style-type: none"> <li>Prendre et fixer un rendez-vous.</li> <li>Demander et indiquer l'heure.</li> </ul>	Organiser une soirée au cinéma avec des amis, par téléphone et par courriel.	<ul style="list-style-type: none"> <li>Comprendre des personnes qui fixent un rendez-vous par téléphonique.</li> <li>Prendre un rendez-vous par téléphone</li> </ul>
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## Unit III

12 h

<ul style="list-style-type: none"> <li>Exprimer son point de vue positif et négatif.</li> <li>S'informer sur le prix.</li> <li>S'informer sur la quantité.</li> <li>Exprimer la quantité.</li> </ul>	En groupes, choisir un cadeau pour un ami.	<ul style="list-style-type: none"> <li>Exprimer son point de vue sur des idées de cadeau.</li> <li>Faire des achats dans un magasin</li> </ul>
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## Unit IV

12 h

<ul style="list-style-type: none"> <li>Demander et indiquer une direction.</li> <li>Localiser (près de, en face de ....).</li> </ul>	Suivre un itinéraire à l'aide d'indications par téléphone et d'un plan.	<ul style="list-style-type: none"> <li>Comprendre des indications de direction.</li> <li>Comprendre des indications de lieu.</li> </ul>
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## Unit V


12 h

<ul style="list-style-type: none"> <li>Exprimer l'obligation et l'interdit.</li> <li>Conseiller.</li> </ul>	Par courrier électronique, donner des informations et des conseils à un ami qui veut voyager.	<ul style="list-style-type: none"> <li>Comprendre une chanson.</li> <li>Comprendre de courts messages qui expriment l'obligation ou l'interdiction</li> <li>Donner des conseils à des personnes dans des situations données.</li> </ul>
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## Text Books

- 1 LATITUDES 1 (Méthode de français) Pages from 56 to 101, Author : RÉGINE MÉRIEUX Publisher : GOYAL Publishers & Distributors Pvt

		
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Course Code	Course Name	Category	L	T	P	Credit
211EL1A2EA	PROFESSIONAL ENGLISH - II	LANGUAGE	4	-	1	3

### PREAMBLE

This course has been designed for students to learn and understand

- The effect of dialogue, the brilliance of imagery and the magnificence of varied genres
- The vocabulary and to frame sentence structure
- The transactional concept of English language

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Interpret skills in communication and to shape their attitude	K2
CO2	Develop oral and written language skills in a business context	K3
CO3	Analyze to gain key strategies and expressions for communicating with professionals	K3
CO4	Inspect the knowledge to the corporate needs	K4
CO5	Formulate Inter and Intrapersonal skills	K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	S	S	S
CO3	M	S	S	S	M
CO4	S	S	M	S	M
CO5	S	S	S	S	M

S Strong

M Medium

L Low



211EL1A2EA	PROFESSIONAL ENGLISH - II	SEMESTER II
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Total Credits: 3

Total Instruction Hours: 60 h

### Syllabus

**Unit I** Technical English 12 h

Communication: Process- Methods- Channels- Barriers of Communications

Phonetics: Basics of phonetics - Consonants and Vowel sounds

Reading Skills: Skimming and Scanning- Reading Different Kinds of Texts- Types- Developing a Good Reading Speed

Writing Skills: Note- Making and note taking, Paragraph Writing: Structure and principles

**Unit II** Business English 12 h

Structure and Planning of Letters: Elements of Structure- Forms of Layout- Style- Writing Business Letters

Quotation, Order and Tender: Inviting - Sending Quotation letter - Placing Orders- Inviting Tenders

E-mail Correspondence: Structure- Procedure- Style- Guidelines- Jargon and Acronyms- Security Precaution

Seminar and Meetings: Introduction- Organizing a Seminar- Sample Brochure- Conducting and Participating in a Meeting

**Unit III** Professional English 12 h

Report Writing: Importance- Process- Types- Structure

Memo: Importance- Structure

Notice, Agenda and Minutes: Meeting- Notice- Agenda- Minutes: Preparation- Structure- Delivery

Brochures: Purpose- Audience- Qualities

**Unit IV** Employment Communication 12 h

Resume Writing : Elements of Resume - difference between CV and Resume - Writing Job Application

Art of Conversation: Small Talk- Body Language- Principles of Good Conversation

Interview: Organizational role- Goals- Types- Interview Process

Group Discussion: Importance- Features- Strategies- Barriers



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**Unit V      Soft Skills**

12 h

Self - Discovery and Goal Setting: Self - Discovery - Goals and Types- Benefits, Areas and Clarity of Goal Setting

Positive Thinking (PT) and Attitude: Benefits of PT and Attitude- Develop Positive Attitude and Thinking- Drive out Negative Thinking and Attitude


Etiquettes and Manners: Home, Table and Business, Time Management

**Text Books**

- 1 Prabha, Dr. R. Vithya & S. Nithya Devi. 2019. Sparkle. (1st Edn.) McGraw - Hill Education. Chennai. [Unit I - V]

**References**

- 1 Ghosh, B.N. Editor. 2017. Managing Soft Skills for Personality Development. McGraw - Hill Education, Chennai.
- 2 Adams, Katherine L. and Gloria I. Galanes. 2018. Communicating in Groups- Applications and Skills. McGraw - Hill Education, Chennai.
- 3 Koneru, Aruna. 2017. Professional Communication. McGraw - Hill Education, Chennai.
- 4 Koneru, Aruna. 2011. English Language Skills. McGraw - Hill Education, Chennai.

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Course Code	Course Name	Category	L	T	P	Credit
193BT1A2CA	MOLECULAR BIOLOGY	CORE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- the basic concept of life.
- the process of cellular mechanisms.
- the process of transcriptional events.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basics of DNA and RNA	K1, K2
CO2	Imparts knowledge on the mode of DNA replication	K1, K2
CO3	Provided in-depth knowledge of transcriptional events	K2, K3
CO4	Focus on translational events and its role in gene Expression	K2, K3
CO5	Know the concept of DNA mutation and repair mechanisms	K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	M	M	S	M	M

S Strong

M Medium

L Low



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193BT1A2CA	MOLECULAR BIOLOGY	SEMESTER II
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Total Credits: 3

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Historical and Conceptual Background 12 h

Discovery of DNA as genetic material - Griffith's experiment, Avery, Macleod and McCarty Experiment and Hershy and Chase experiment. Structure of Nucleoside and Nucleotide. Structure of DNA (Watson and Crick Model), Types of DNA (A-DNA, B-DNA and Z- DNA). Structure and Types of RNA (mRNA, tRNA and rRNA).

#### Unit II Central Dogma & Replication 13 h

Over view of Central dogma, Experimental proof for Semi conservative method. Enzymes & accessory proteins involved in DNA replication. Replication process in prokaryotic & Eukaryotic DNA. Differences between Prokaryotic and eukaryotic replication. Rolling circle model of replication.

#### Unit III Transcription 13 h

Importance of DNA binding Proteins, RNA polymerase. Mechanism of Transcription in prokaryotes & Eukaryotes. Differences between Prokaryotic and eukaryotic transcription. Post transcriptional Modifications in RNA - 5' cap formation, 3'-end polyadenylation. Splicing and Processing of m- RNA, r-RNA & t-RNA. Transcriptional regulation in prokaryotes - lac operon and trp operon.

#### Unit IV Translation 12 h

Overview of Genetic code, wobble hypothesis. Mechanism of translation in Prokaryotes & Eukaryotes. Post translational modifications of proteins- Phosphorylation, Deformylation, Glycosylation, Acetylation, Amidation, Lipid attachment, S - Nitrosylation and Disulfide bond formation. Translational inhibitors.

#### Unit V Mutation and DNA Repair 10 h

Mutation: Types of Mutation, Mutants (Physical and Chemical). DNA repair mechanism-Nucleotide excision, base excision, Mismatch repair, Photo reactivation, SOS and recombination repair




## Text Books

- 1 Lodish H & Baltimore D, 1994, "Molecular Cell Biology", 2nd Edition, American Scientific Books, United States
- 2 De Robertis, 2003, "Cell and Molecular Biology", 8th Edition, EDP Lippincott Williams, USA

## References

- 1 Lewin B, 2004, "Genes V" , 5th Edition, Oxford University Press , USA .
- 2 Gerald Karp, 2002, "Cell and Molecular Biology", 3rd Edition, John Wiley Sons, United States
- 3 Freifelder D & Malacinski GM, 1996, "Essential of Molecular Biology", 2nd Edition, Panima Publishing Co, New Delhi.
- 4 De Robertis EMF & Eduardo de Robertis, 2017, "Cell and Molecular Biology", 8th Edition, CCH, Wolters Kluwer Business, United States

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A2CB	MICROBIOLOGY	CORE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- Define the science of microbiology and general techniques used.
- Describe beneficial and harmful activities of microorganisms to humans.
- Applications of microbiological clinically.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamental concepts of microbiology	K1
CO2	Know the basics of media preparation and different sterilization techniques	K1, K2
CO3	Distinguish different phases in microbial growth and learn about nutritional classification	K2,K3
CO4	Discuss the structure, reproduction and the causative diseases of bacteria	K2,K3
CO5	Discuss the structure, reproduction and the causative diseases of virus	K2,K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M
CO2	S	M	S	S	S
CO3	M	M	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong

M Medium

L Low



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193BT1A2CB	MICROBIOLOGY	SEMESTER II
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Total Credits: 3

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Concepts of Microbiology 12 h

History of Microbiology - Biogenesis Vs Abiogenesis, Contributions of Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming. Light microscopy - Bright, Dark Field, Phase contrast, Fluorescence. Electron Microscopy - Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

#### Unit II Media, Sterilization Techniques and Growth of Microbes 12 h

Sterilization- Methods - Physical - Dry Heat, Moist Heat, Cold sterilization and Chemical. Preparation of Culture Media - types. Growth curve - Determination of Generation Time, Measurement of Growth - Viable count, Turbidometry and Direct Cell count. Nutritional classification of microbes.

#### Unit III Bacteria - Structure and its causative diseases 12 h

Classification (Berg's manual) - Bacterial Structure, Reproduction of Bacteria. Diseases caused by Mycobacterium tuberculosis (Tuberculosis), Salmonella typhi (Typhoid), Vibrio cholera (Cholera), Clostridium tetani (Tetanus) and Staphylococcus aureus (Skin Infections).

#### Unit IV Virus - Structure and its causative diseases 12 h

Virus structure, Classification (Baltimore), Reproduction - Generalized and Specialized, Diseases caused HIV (AIDS), Hepatitis B Virus (Jaundice), Varicella zoster (Chicken Pox) and Polio myelitis (Polio).

#### Unit V Fungus - structure and its causative diseases 12 h

Fungal structure - classification - reproduction. Tinea rubrum (body ringworm), Tinea pedis (athlete's foot), Candida species (bronchitis), Acitnomycetes isreltii (oral infection), Aspergillosis fumigates (sinus, bronchi, lungs).






## Text Books

- 1 Atlas M Ronald, 1995, "Principles of Microbiology", 2nd Edition, McGraw-Hill Publication, India.
- 2 Pelzar M, 2001, "Microbiology", 5th edition, McGraw Hill Education (India) Pvt Ltd, India.

## References

- 1 Prescott L M, John P H, Donald A K, 2004, "Microbiology", 6th Edition, McGraw-Hill Science Publication, USA.
- 2 Gerard J T, 2012, "Microbiology: An Introduction", 11th edition, Benjamin Cummings Publishers, USA.
- 3 Vidhyasekaran P, 2008, Fungal pathogenesis in plants and crops: molecular biology and host defence mechanisms, 2nd Edition, CRC Press, USA.
- 4 Crueger and A Crueger, 1990, "Biotechnology: A textbook of Industrial Microbiology", 1st Edition, Sinauer associates, USA.

		
Dr.N.G.P. Arts and Sci		
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BoS- 12 <sup>th</sup>	AC - 12 <sup>th</sup>	GB - 17 <sup>th</sup>
08.01.2022	23.03.2022	28.03.2022



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COIMBATORE | INDIA

*B.Sc. Biotechnology (Students admitted during the AY 2021-22)*

193BT1A2CP	<b>CORE PRACTICAL II : MOLECULAR BIOLOGY &amp; MICROBIOLOGY</b>	<b>SEMESTER II</b>
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**Total Credits: 2**  
**Total Instructions Hours: 48 h**

S.No	List of Experiments
1	Isolation of DNA from Plant
2	Isolation of DNA from Animal tissue
3	Isolation of DNA from Bacteria
4	UV mutagenesis
5	Staining of Bacteria – Negative and Gram staining
6	Fungal Staining
7	Observation of fungi under stereomicroscope*
8	Isolation of microorganism from soil by serial dilution method
9	Bacterial growth curve
10	Antibiotic sensitivity test
11	Methylene Blue Reduction test

**Note:** 9 is Mandatory out of 11. DBT STAR College Experiment\*





## References

- 1 Sambrook J, Green MR, 2012, "Molecular Cloning: A Laboratory manual", 4th edition, Cold Spring Harbor, USA
- 2 Chaitanya KV, 2013, "Cell and Molecular Biology: A Lab Manual", Phi Publisher, India
- 3 Cappuccino, 2005, "Microbiology: A Laboratory Manual", Pearson Education, UK.
- 4 Kannan N, 2002, "Laboratory Manual in General Microbiology", Panima Publishers, India

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12 <sup>th</sup>	AC - 12 <sup>th</sup>	17 <sup>th</sup>
08.01.2022	23.03.2022	28.03.2022



Course Code	Course Name	Category	L	T	P	Credit
194CT1A2IC	COMPUTERS FOR BIOLOGISTS	IDC	4	-	-	4

#### PREAMBLE:

- To enable the students to understand the fundamentals of Computer
- To understand the basic concepts of Word, Power Point, Excel.
- To know the idea on biological data processing

#### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of Computer	K1, K2
CO2	Learn the concept of MS-Word	K1, K2
CO3	Apply the creativity of slide presentation	K2, K3
CO4	Apply the formulas and functions in Excel	K3
CO5	Knowledge on biological data	K3

#### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S Strong

M Medium

L Low





194CT1A2IC	COMPUTERS FOR BIOLOGIST	SEMESTER II
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**Total Credits: 4**

**Total Instructions Hours: 48**

### Syllabus

#### Unit I 10

Architecture of Computers – Concepts of Computers , parts, storage device – Data Storage- Hardware and Software- Computer Languages and Operating Systems- Networking of Systems-Internet-Search Engines, LAN, WAN – Email - Password Security

#### Unit II 8

Ms-Office : Microsoft Word – Introduction- Basics of using MS-Word – Formatting – Text Creation- Advanced features- Application of MS-Word

#### Unit III 8

Ms- Power Point : Presentation Creation – Add visual enhancements- Work with Slides and Slide text- Hyperlink and Functions - Animations

#### Unit IV 10

Ms-Excel : Introduction – Tools in Excel Manipulation of Cells- Formulas, functions and operations – Formatting - Charts – Macros – Advanced Excel –Biological Data Processing in Excel

#### Unit V 12

Computing Changing Biology – Database - DB Collection –DB organizing – Types of data : Gene data- DNA data- Text data- Image data- Video data- Software Support for data analysis

### TEXT BOOKS

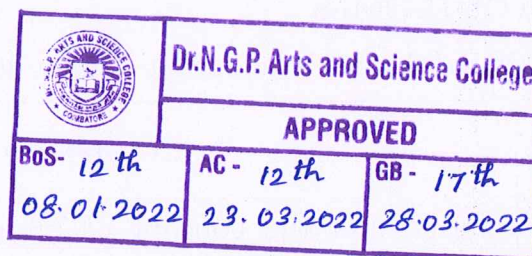
- 1 Gary B. Shelly, Misty E. Vermaat, 2010, "Discovering Computers and Microsoft Office 2010: A Fundamental Combined Approach", Cengage Learning Publication (Unit I – IV)



- 2 Cynthia Givase, Per Jambeck, , Developing Bio Informatics Computer Skills  
O'Reily Media (Unit V)

#### REFERENCES:

- 1 Elaine Marmel , 2016, " Microsoft Office 2016" , John Wiley Publishers
- 2 Joan Lambert and Joyce Cox , 2013, "Microsoft Power Point 2013" , Microsoft Press





Course Code	Course Name	Category	L	T	P	Credit
196BM1A2AA	HUMAN RIGHTS	AECC	2	-	-	2

### PREAMBLE

This course has been designed for students to learn and understand

- To study how human values and personality traits help to develop the characteristics of each individual
- Understanding the moral values towards the enrichment of the society
- Identify the impact of ethics and values on the global development of the current scenario

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of human values, personality traits and character formation.	K2
CO2	Acquire the knowledge through value education towards national and global development.	K1
CO3	Introduce the basic concepts of conflict, emotions and adolescent emotions.	K1
CO4	Illustrate the techniques in therapeutic measures like yoga and meditation.	K2
CO5	Learn the concepts of human rights, rights for women and children and domestic violence.	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	M	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S Strong

M Medium

L Low



196BM1A2AA	HUMAN RIGHTS	SEMESTER II
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Total Credits: 2

Total Instruction Hours: 24 h

### Syllabus

#### Unit I Introduction to Human Values 05 h

Concept of Human Values - Value Education Towards Personal Development - Aim of education and value education - Evolution of value oriented education - Concept of Human values - Types of values - Components of value education - Personal Development: Self analysis and introspection - Sensitization towards gender equality - Physically challenged - Intellectually challenged - Respect to age - Experience - Maturity - Family members - Neighbours - Co-workers - Character Formation towards Positive Personality: Truthfulness - Constructivity - Sacrifice - Sincerity - Self Control - Altruism - Tolerance - Scientific Vision.

#### Unit II Value Education and Social Values 05 h

Value Education Towards National and Global Development National and International Values: Constitutional or national values - Democracy - Socialism - Secularism - Equality - Justice - Liberty - Freedom and fraternity - Social Values - Pity and probity - Self control - Universal brotherhood - Professional Values - Knowledge thirst - Sincerity in profession - Regularity - Punctuality and faith - Religious Values - Tolerance - Wisdom - Character - Aesthetic values - Love and appreciation of literature and fine arts and respect for the same - National Integration and international understanding.

#### Unit III Global Development on Ethics and Values 04 h

Impact of Global Development on Ethics and Values: Conflict of cross-cultural influences - Mass media - Cross-border education - Materialistic values - Professional challenges and compromise - Modern Challenges of Adolescent Emotions and behave or Sex and spirituality: Comparison and competition - Positive and negative thoughts - Adolescent Emotions - Arrogance - Anger - Sexual instability - Selfishness - defiance.

#### Unit IV Yoga and Meditation 05 h

Therapeutic Measures: Control of the mind through - Simplified physical exercise - Meditation - Objectives - Types - Effect on body - Mind - Soul - Yoga - Objectives - Types - Asanas - Activities: Moralisation of Desires - Neutralisation of Anger - Eradication of Worries - Benefits of Blessings.





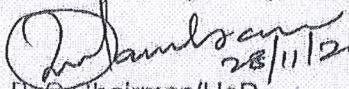
**Unit V Human Rights and Rights of Women and Children**

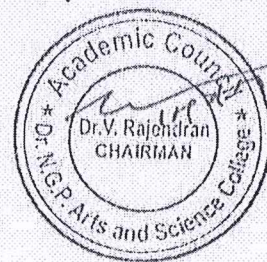
05 h

Human Rights - Concept of Human Rights – Indian and International Perspectives  
 - Evolution of Human Rights - Definitions under Indian and International documents - Broad classification of Human Rights and Relevant Constitutional Provisions - Right to Life - Liberty and Dignity - Right to Equality - Right against Exploitation - Cultural and Educational Rights - Economic Rights - Political Rights - Social Rights - Human Rights of Women and Children - Social Practice and Constitutional Safeguards - Female Foeticide and Infanticide - Physical assault and harassment - Domestic violence - Conditions of Working Women - Institutions for Implementation - Human Rights Commission - Judiciary - Violations and Redressal Violation by State - Violation by Individuals - Nuclear Weapons and Terrorism Safeguards.

**References**

- 1 Brain Trust Aliyar, 2008, Value Education for health, happiness and harmony. Vethathiri publications, Erode
- 2 Grose. D. N, 2005, A text book of Value Education. Dominant Publishers and Distributors, New Delhi.
- 3 Yogesh Kumar Singh & Ruchika Nath, 2005, Value Education, P. H Publishing Corporation, New Delhi.
- 4 Venkataram. & Sandhiya. N, 2001, Research in Value Education, APH Publishing Corporation, New Delhi.
- 5 Seetharam. R. (Ed), 1998, Becoming a better Teacher Madras Academic Staff College.
- 6 Brain Trust Aliyar, 2004, Value Education for Health, Happiness and Harmony. Vethathiri publications, Erode.
- 7 Swami Vivekananda, 2008, Personality Development. Advaita Ashrama, Kolkata.
- 8 Dey A. K, 2002, Environmental Chemistry. New Delhi – Vile Dasasus Ltd.

  
 28/11/2020  
 BOS Chairman/HoD  
 Department of Biotechnology  
 Dr. N. G. P. Arts and Science College  
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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
Part I										
191TL1A3TA	Language -I	Tamil – III	3	1	-	3	25	75	100	3
191TL1A3HA		Hindi – III								
191TL1A3MA		Malayalam –III								
201TL1A3FA		French - III								
Part - II										
191EL1A3EA	Language -II	English - III	3		1	3	25	75	100	3
Part - III										
193BT1A3CA	Core V	Genetics	3	1	-	3	25	75	100	3
193BT1A3CB	Core VI	Biochemistry	2	1	-	3	25	75	100	3
193BT1A3CP	Core Practical III	Genetics & Biochemistry	-	-	4	5	40	60	100	2
192MT1A3ID	IDC III	Mathematics	4	-	-	3	25	75	100	4
193BT1A3SA	SEC I	Personality Development	3	-	-	3	25	75	100	3
	GE I		2	-	-	2	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A3AA	AECC - III	Basic Tamil	2	-	-	-	-	50	50	2
191TL1A3AB		Advanced Tamil								
195CR1A3AA		Women’s Rights								
Total			22	3	5				800	25

### EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No.	Course Code	Course Name
1	193BT1ASSA	Environmental Management
2	193BT1ASSB	Biofertilizer Technology





Course Code	Course Name	Category	L	T	P	Credit
191TL1A3TA	தமிழ்த் தாள்- III	மொழி-I	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- மொழிப்பாடங்களின் வாயிலாக தமிழரின் பண்பாடு , பகுத்தறிவு ஆகியவற்றை அறியச் செய்தல்
- கலை மற்றும் மரபுகளை அறியச் செய்தல்
- மாணவர்களின் படைப்பாக்கத்திறன்களை ஊக்குவித்தல்

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	வாழ்க்கைத்திறன்கள் (Life Skills) – மாணவனின் செயலாக்கத்திறனை ஊக்குவித்தல்	K1,K2,K3
CO2	மதிப்புக்கல்வி (Attitude and Value education)	K2,K4
CO3	பாட இணைச்செயல்பாடுகள் (Co-curricular activities)	K2,K3,K4
CO4	சூழலியல் ஆக்கம் (Ecology)	K4
CO5	மொழி அறிவு(Tamil knowledge)	K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong

M Medium

L Low



191TL1A3TA	பகுதி - 1 : தமிழ் தாள் : 3	SEMESTER III
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

#### Unit I

10 h

1. காப்பியங்களின் தோற்றமும் வளர்ச்சியும்
2. சிலப்பதிகாரம் - மனையறம் படுத்த காதை
3. மணிமேகலை - வஞ்சிமாநகர் புக்க காதை

#### Unit II

10 h

1. கம்பராமாயணம் - கும்பகர்ணன் வதைப்படலம் (பா. எண் : 60 - 100)
2. பெரிய புராணம் - அதிபத்தநாயனார் புராணம்

#### Unit III

10 h

1. சிற்றிலக்கியங்களின் தோற்றமும் வளர்ச்சியும்
2. தமிழ்விடு தூது - தூதுப்பொருள்கள் மட்டும் 101 முதல் 112 வரை (12 கண்ணிகள்)
3. திருக்குற்றாலக்குறவஞ்சி - வசந்தவல்லி பந்தாடிய சிறப்பு (6: 4 கண்ணிகள்)
4. கலிங்கத்துப்பரணி - களம் பாடியது (போர்க்களக் காட்சி - பா. எண்: 472-502)

#### Unit IV

10 h

1. நாடகங்களின் தோற்றமும் வளர்ச்சியும்
2. நாடகம் - ஓளவை-ஆசிரியர் இன்குலாப்

#### Unit V

08 h

1. 'பா' வகைகள் : வெண்பா, ஆசிரியப்பா, கலிப்பா, வஞ்சிப்பா - பொது இலக்கணம் மட்டும்.
2. அணி: உவமையணி, உருவக அணி, இல்பொருள் உவமையணி விளக்கம், உதாரணம்.



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

அ) அலுவலகம் சார்ந்த கடிதம்: விண்ணப்பங்கள், வேண்டுகோள், முறையீடு,



ஆ) வாசகர் கடிதம்: நாளிதழ், வானொலி, செய்தி ஊடகங்களுக்கு


விமர்சனம் எழுதுதல்.

### Text Books

- 1 மொழிப்பாடம் - 2020, தொகுப்பு : தமிழ்த்துறை , டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி.
- 2 இன்குலாப் - 2017. ஒளவை (நாடகம்), அன்னம் வெளியீடு, சென்னை.

### References

- 1 புலவர் சோம. இளவரசு - 2014. இலக்கிய வரலாறு , மணிவாசகர் பதிப்பகம் , சென்னை - 108,
- 2 பேராசிரியர் முனைவர் பாக்யமேரி - முதற் பதிப்பு 2013 , இலக்கணம் இலக்கிய வரலாறு மொழித்திறன், பூவேந்தன் பதிப்பகம், சென்னை.
- 3 இணையதள முகவரி : [www.tamilvirtual.com](http://www.tamilvirtual.com)

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08.01.22	23.03.22	28.03.22



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

Course Code	Course Name	Category	L	T	P	Credit
191TL1A3HA	HINDI-III	Language - I	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



Dr. NGPASC

COIMBATORE | INDIA

B.Sc. Biotechnology (Students admitted during the AY 2021-22)



191TL1A3HA	HINDI-III	SEMESTER III
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Total Credits: 03

Total Instruction Hours: 48 h

## Syllabus

## Unit I 10 h

पद्य – काव्य पराशर (भोलानाथ)

(प्राचीन- कबीर, तुलसी, सुर, मीरा, आधुनिक- मैथिलीशरण गुप्त, अरुण कमल )

प्रकाशक: जवाहर पुस्तकालय

सदर बाजार, मथुरा

उत्तर प्रदेश - 281001

## Unit II 10 h

हिन्दी साहित्य का इतिहास: (साधारण ज्ञान)

आचार्य रामचन्द्र शुक्ल

लोकभारती प्रकाशन इलाहाबाद

## Unit III 10 h

अलंकार: अनुप्रास, यमक, श्लेष, वक्रोक्ति, उपमा, रूपक

प्रकाशक: विनोद पुस्तक मंदिर

आगरा - 282002

## Unit IV 10 h

संवाद लेखन

पुस्तक: व्याकरण प्रदीप – रामदेव

प्रकाशक: हिन्दी भवन 36 इलाहाबाद - 211024

## Unit V 08 h

अनुवाद अभ्यास-III (केवल हिन्दी से अंग्रेजी में)

(पाठ 10 to 20)

प्रकाशक: दक्षिण भारत प्रचार सभा चेन्नई -17



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

Course Code	Course Name	Category	L	T	P	Credit
191TL1A3MA	MALAYALAM - III	Language - I	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



191TL1A3MA	MALAYALAM - III	SEMESTER III
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

Unit I	10 h
Kumaranasan	
Unit II	10 h
Kumaranasan	
Unit III	10 h
Kumaranasan	
Unit IV	10 h
Kavyanchali Collection of Poems.	
Unit V	08 h
Kavyanchali Collection of Poems.	

### Text Books

- 1 Chinthavishtayaya Sitha By Kumaranasan DC.Books Kottayam
- 2 Kavyanchali -Group of Authors DC.Books Kottayam

### References

- 1 Kavitha Sahithya Charithram -Dr.M.Leelavathy Sahithya academy Thrissur.

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SS-12 <sup>th</sup>	AC-12 <sup>th</sup>	GB-17 <sup>th</sup>
08.1.22	23.03.22	28.03.22



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

Course Code	Course Name	Category	L	T	P	Credit
201TL1A3FA	FRENCH -III	LANGUAGE-1	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To Acquire Competence in General Communication Skills – Oral + Written – Comprehension & Expression.
- To Introduce the Culture, life style and the civilization aspects of the French people as well as of France.
- To help the students to acquire Competency in translating simple French sentences into English and vice versa.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents.	K1
CO2	To learn the adjectives and the classroom environment in France.	K2
CO3	Learn the Plural, Articles and the Hobbies.	K3
CO4	To learn the Cultural Activity in France.	K3
CO5	To learn the Sentiments, life style of the French people and the usage of the conditional tense.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low





201TL1A3FA	FRENCH - III	SEMESTER III
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Total Credits: 3

Total Instruction Hours: 48 h

## Syllabus

## Unit I

10 h

<ul style="list-style-type: none"> <li>◦ Décrire un lieu.</li> <li>◦ Situer</li> <li>◦ Se situer dans le temps.</li> </ul>	A partir d'une recherche de documents, composer une présentation touristique pour un magazine ou un site internet.	Comprendre la description d'un lieu. Décrire une ville ou une région qu'on aime. Interroger sur la situation d'un lieu. Comprendre des indications sur la fréquence d'actions.	Comprendre une présentation de catalogue touristique. Comprendre des pictogrammes. Comprendre la description d'un lieu et d'une situation précise dans un message électronique.
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## Unit II

8 h

<ul style="list-style-type: none"> <li>◦ Raconter.</li> <li>◦ Décrire les étapes d'une action.</li> </ul>	Raconter une scène insolite à l'oral et à l'écrit.	Comprendre le récit d'un voyage. Raconter ses actions quotidiennes.	Décrire une biographie à partir d'éléments écrits.
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## Unit III

10 h

<ul style="list-style-type: none"> <li>◦ Exprimer l'intensité et la quantité.</li> <li>◦ Interroger.</li> </ul>	Raconter une scène insolite à l'oral et à l'écrit.	Comprendre le récit d'un voyage. Raconter ses actions quotidiennes.	Décrire une biographie à partir d'éléments écrits.
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## Unit IV

10 h

<ul style="list-style-type: none"> <li>◦ Décrire quelqu'un.</li> <li>◦ Comparer</li> <li>◦ Exprimer l'accord ou le désaccord.</li> <li>◦ Se situer dans le temps.</li> </ul>	En milieu professionnel, recruter quelqu'un et justifier son choix.	S'exprimer sur les styles de vêtements. Reconnaître des personnes à partir de descriptions. Décrire des personnes. Comprendre des personnes qui expriment leur accord ou leur désaccord.	Comprendre la description de personnes dans un extrait de roman. Comprendre des différences de points de vue exprimés dans de message électronique. Raconter un souvenir.
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Course Code	Course Name	Category	L	T	P	Credit
191EL1A3EA	ENGLISH - III	Language II	4	0	0	3

### PREAMBLE

This course has been designed for students to learn and understand

- The basics of English grammar and specific usage
- The importance of the vocabulary and use in different contexts
- The necessity of communication and composition writing skills

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn English grammar and its specific usage	K2
CO2	Know the methods of improving reading skills	K3
CO3	Understand the importance of speaking skills and developing it through various practices	K3
CO4	Comprehend the basic steps of reading and its necessity	K3
CO5	Acquire the writing skills and mandatory similar practices	K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	S	S	S	S	S
CO3	M	M	S	M	S
CO4	S	S	S	S	M
CO5	M	S	M	S	S

S Strong

M Medium

L Low



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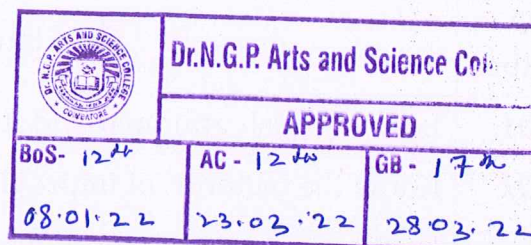
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<ul style="list-style-type: none"> <li>° Parler de l'avenir.</li> <li>° Exprimer des souhaits.</li> <li>° Décrire quelqu'un.</li> </ul>	Discuter de l'organisation d'un voyage de groupe puis préparer une fiche projet et la présenter.	Comprendre une chanson. Échanger sur des projets de vacances Discuter du programme de la soirée à venir. Addresser des souhaits à quelqu'un	Comprendre le message d'une carte d'anniversaire.
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## Text Books

- 1 LATITUDES 1 (Méthode de français) Pages from 102-151, Author : Regine Mérieux, Yves Loiseau



191EL1A3EA	ENGLISH - III	SEMESTER III
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

**Unit I** Basics of English 10 h

Phrasal verb - Notions and Conventional Idiomatic Expressions - One-Word Substitution - Word Formation - Homophones - Spelling - Sentence Completion - Sentence Pattern

**Unit II** Listening 08 h

Listening and Hearing - Principles of listening - Types of listening - incidental listening - active and effective listening - discriminative listening - critical listening - listening vs practice - Barrier to Listening - Guidelines for Improving Listening

**Unit III** Speaking 10 h

Monologues - Dialogue - Role Play - JAM (Just A Minute talk) - Debate - Public Speaking - Group Discussion - Interview - Showing Directions - Accent and Neutralization

**Unit IV** Reading 10 h

Mechanics of Reading - Types of Reading - Summarization - Paraphrasing - Analysis and Interpretation - Reading Comprehension - Reading with purpose and making predictions - Cloze Passage

**Unit V** Writing 10 h

Paraphrase Writing - Techniques and Methods of Paraphrasing - Precis Writing - Difference between Paraphrase and Precis - review writing - Hints Developing - Editorial Writing - Tabloid - Column Writing






### Text Books

- 1 Bhatnagar R. P. 2013. English for Competitive Examinations. Macmillan Publishers, Chennai.
- 2 Koneru Aruna. 2011. English Language Skills. McGraw Hill Education, Chennai.

### References

- 1 Radhakrishna Pillai G. 2000. English for Success. Emerald Publishers, Chennai.
- 2 Gauri Mishra, Ranjana Kaul. 2016. Language Through Literature. Primus Books, New Delhi.
- 3 Miles Craven. 2008. Cambridge English Skills Real Listening and Speaking. First Edition, Cambridge University Press, India.
- 4 Teaching Adult: A Literary Resource Book. 2012. New Readers Press, New York, United States.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A3CA	GENETICS	CORE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- Concepts of Mendelian and Non-Mendelian inheritance
- Theory of inheritance and gene interaction
- The overview on genetic disorders

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the history and concept of Mendelian laws	K1, K2
CO2	Recognize the structure of chromosome, gene and its interaction	K1, K2
CO3	Differentiate the natural horizontal gene transfer methods	K1, K2
CO4	Interpret chromosomal variations and genetic disorders	K1, K2, K3
CO5	Classify the pedigree analysis and administer genetic counseling	K1, K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	M	M	S
CO4	S	M	M	M	S
CO5	S	S	S	S	S

S Strong

M Medium

L Low



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193BT1A3CA	GENETICS	SEMESTER III
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**Total Credits: 3**

**Total Instruction Hours: 48 h**

### Syllabus

**Unit I** Mendelian & Non Mendelian Inheritance 09 h

History of Genetics, Mendel's work: Monohybrid Experiment, Dihybrid Experiment, Back Cross and Test Cross. Chromosomal theory of Inheritance, Extranuclear inheritance (mitochondrial, chloroplast), Maternal inheritance.

**Unit II** Concept of Gene, Alleles and Chromosome 10 h

Gene vs Allele, Multiple Alleles, Pseudo alleles, Gene Interactions: Allelic (Co-Dominance, Incomplete Dominance), Non Allelic (Epistasis and Lethal genes). Concept of loci on Chromosome, Structure of Prokaryote and Eukaryote chromosome, Karyotyping

**Unit III** Chromosomal Variations and Abberations 10 h

Mutation- Physical and Chemical, Numerical – Euploidy and Aneuploidy; Structural (deletion, duplication, inversion and translocation). Single Gene Disorders: Autosomal Dominant -Achondroplasia, polycystic kidney, Autosomal Recessive - Cystic fibrosis, Sickle cell Anaemia, X- linked Dominant - Rett syndrome, X linked recessive - Haemophilia, Multifactorial - Cleft lip and palate

**Unit IV** Natural Horizontal Gene Transfer Methods 09 h

Genetic analysis of bacteria - Bacterial transformation, Conjugation (sex factor, Hfr strain, F' factor), Transduction in Bacteria (General and Specialized), Linkage and Crossing over, Recombination- Holliday model

**Unit V** Transposons and Population Genetics 10 h

Model organism for genetic analysis of development- Drosophila & Arabidopsis. Transposable elements of Prokaryotes (IS Elements, Composite and Tn3 Family) and Eukaryotes (Maize transposable elements). Gene frequency, Hardy – Weinberg law



Course Code	Course Name	Category	L	T	P	Credit
193BT1A3CB	BIOCHEMISTRY	CORE	2	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The structure & function of bio molecules
- The aspects of metabolism & their regulatory pathways
- The classification, structure, functions of biomolecules and its metabolism

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify the concepts of biochemical pathways and carbohydrates	K1, K2
CO2	Paraphrase the classification, structure, properties and metabolism of amino acids and protein	K1, K2
CO3	Discuss the classification, structure, properties, biosynthesis and oxidation of lipids	K1, K2
CO4	Compare the classification, structure, functions of nucleic acids and metabolism of nucleotides	K2, K3
CO5	Categorize the classification of enzymes, mechanism of action and enzyme kinetics	K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	M	S	S
CO5	S	M	S	S	S

**S Strong**

**M Medium**

**L Low**

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## Text Books

- 1 Strickberger, M. W. 2013. Genetics. 3rd edition. Prentice Hall College Division, New Delhi.
- 2 Winter, P.C., Hickey, G. I. and Fletcher, H.L. 2000. Genetics. 1st edition. Viva Books Pvt Ltd., India

## References

- 1 Trun, N. and Trempey, J. 2004. Fundamental Bacterial Genetics. Blackwell publishing. Singapore
- 2 Strachan, T. and Read, A. P. 2006. Human Molecular Genetics. 3rd Edition. Wiley & Sons. United States
- 3 Maquat, L. 2018. Molecular Biology. 5th edition. CRC Press. United States
- 4 Brown, T. A. 1999. Genetics. 3rd edition. Chapman and Hall. London, UK

		
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193BT1A3CB	BIOCHEMISTRY	SEMESTER III
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Total Credits: 3

Total Instruction Hours: 36 h

### Syllabus

#### Unit I Carbohydrates 7 h

Structure and classification, Glycolysis and gluconeogenesis. Krebs's cycle. Electron transport chain. HMP shunt pathway

#### Unit II Protein 7 h

Amino acid: Essential and non essential amino acids, Properties and Metabolism of amino acids (Glycine and Tryptophan). Protein: Classification and Properties – four levels of protein structure & conformations, Ramachandran Plot.

#### Unit III Lipids 7 h

Lipids: Nomenclature, Classification and biological significance. Simple Lipids and Compound lipids. Synthesis and metabolism of fatty acids ( $\alpha$ ,  $\beta$  and  $\omega$  Oxidation of fatty acids). Cholesterol Biosynthesis and regulation

#### Unit IV Nucleic acids 7 h

Nucleic acids: Classification, structure and functions of nucleic acids, Biosynthesis of Purines and pyrimidines -De novo pathway, Salvage pathway, Regulation and Metabolism of Purine and pyrimidine.

#### Unit V Enzyme kinetics 8 h

Enzymes: Nomenclature and Classifications of enzyme. Coenzymes, Abzymes, Ribozymes. Mechanism of enzyme actions - Active site, Lock and Key model & Induce fit Hypothesis, Enzyme substrate complex formation. Kinetics: Derivation of Michaelis- Menton equation, Types of inhibitions - Competitive, Non Competitive, Uncompetitive, Feedback and Allosteric.






## Text Books

- 1 Murray, R.K., Rodwell, V.W. 2009, Harper's Illustrated Biochemistry, 28th edition, McGraw Hill publications, India
- 2 Berg, J.M., Stryer, L. et al. 2015, Biochemistry, 8th edition, Palgrave Macmillan Publications, India

## References

- 1 Zubay, G.L. 1995. Principles of Biochemistry. 1st edition. WCB publishers. USA.
- 2 Lehninger, A.L. and Cox, M. M. 1993. Principles of Biochemistry. 2nd edition. CBS Publishers And Distributors. New Delhi.
- 3 Fromm, H.J. and Hargrover M. 2012. Essentials of Biochemistry, Kindle edition. Springer publisher
- 4 Voet, D. and Voet, J. G. 1995. Fundamentals of Biochemistry. 2nd edition. John Wiley and Sons Inc. USA

		
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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

193BT1A3CP	CORE PRACTICAL : GENETICS AND BIOCHEMISTRY	SEMESTER III
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Total Credits: 2  
Total Instructions Hours: 48 h

### S.No LIST OF EXPERIMENTS

- 1 Problem solving in Monohybrid cross and dihybrid cross
- 2 Isolation of Auxotrophic Mutants / Antibiotic Resistants by Gradient plate technique
- 3 Sex chromatin observation from Buccal smear \*
- 4 Determination of Phage Titre
- 5 Problem solving in Pedigree Analysis
- 6 Determination of Thermal death time
- 7 Determination of gene frequency using Hardy Weinberg law
- 8 Estimation of Glucose by Anthrone method
- 9 Estimation of Fructose by Dinitro Salicylic Acid method
- 10 Estimation of Amino Acids by Ninhydrin method
- 11 Estimation of Ascorbic acid by DNPH method.
- 12 Estimation of Protein by Lowry's or Bradford's method\*

**Note:** 1) Out of 12 - 10 Mandatory

2) \* DBT STAR experiments

### References


- 1 Mertens, T.R. and Hammersmith, R.L. 1997. Genetics Laboratory Investigations. 11th edition. Benjamin Cummings. USA.
- 2 Sadasivam, S. and Manickam, A. 1996. Biochemical Methods, 4th edition. New Age International. India
- 3 Sambrook, J. and Green, M.R. 2012. Molecular Cloning: A Laboratory Manual. 4th edition. Cold Spring Harbor. USA

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Course Code	Course Name	Category	L	T	P	Credit
192MT1A3ID	MATHEMATICS	IDC	4	-	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- Set operations and their properties
- Importance of Matrix method and simultaneous linear equation.
- probability distribution and test of significance in Chi-square ,t test , F test and ANOVA table

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	explain the concept of Set operations	K1
CO2	demonstrate the concept of Matrix	K2
CO3	apply the concept of Mean , Median and Mode	K3
CO4	recognize the concept of probability distribution , Chi-square test and t test	K3
CO5	analyzing the concept of ANOVA and F test	K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	M	S
CO3	M	S	S	S	M
CO4	M	M	S	S	S
CO5	S	S	S	S	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

192MT1A3ID	MATHEMATICS	SEMESTER III
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**Total Credits: 4**

**Total Instruction Hours: 48 h**

### Syllabus

**Unit I** Set Theory 8 h

Sets-Types of sets - Venn diagram - Set operations - Union -Intersection - Complement - Difference - Law of algebras of sets -Properties of sets - Number of elements -Sums involved in two sets

**Unit II** Matrix 10 h

Matrix Basic Concepts - Types of Matrices - Addition and Multiplication of Matrices - Determinants - Crammer's Rule -Inverse of a Matrix - Matrix Method - Rank of Matrix

**Unit III** Measures of central tendency and dispersion 10 h

Statistics- Meaning - Diagrammatic and Graphical Representation- Measures of Central Tendency-Mean - Median- Mode - Measures of dispersion- Range - Standard deviation

**Unit IV** Probability Distribution 10 h

Probability distributions - Discrete Distribution -BinomialDistribution-Poisson Distribution -Continuous Distribution - Normal Distributions-Student's t test and Chi square test

**Unit V** ANOVA and F -test 10 h

Analysis of Variance- One way Classification - Two way Classification- Three way Classification of data - F- test -Test for single variance and difference between variance only known and unknown variances

**Note:** Theory 20% and Problem 80%



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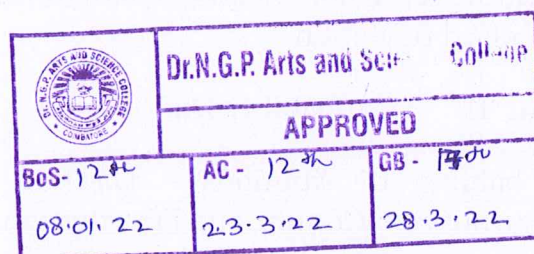


### Text Books

- 1 Vittal.P.R,2012, 'BusinessMathematicsandStatistics', third edition,Margham Publications, Chennai
- 2 Vittal.P.R., 2015, 'Mathematical Statistics ', Margham Publications, Chennai

### References

- 1 Navnitham P.A,2013,'Business Mathematics & Statistics ', second edition , Jai Publishers, Trichy
- 2 Gupta S.P. and Gupta. M.P, 2002, ' Business Statistics ', 17th edition , Sultan Chand andSons, New Delhi
- 3 Das N.G , Das J.K , 2012, ' Business Mathematics and Statistics' , First Edition, McGraw Hill Education Private Limited, Bengaluru
- 4 Gupta.S.C and Kapoor.V.K,2017, ' Fundamentals of Applied Statistics', Sultan Chand and Sons , New Delhi



Course Code	Course Name	Category	L	T	P	Credit
193BT1A3SA	PERSONALITY DEVELOPMENT	SEC	3	-	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- Value of self introspection for better output in education and work
- The strengths of personal effectiveness in all round development
- The importance of communication skills in bioscience

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Sketch the values of self introspection	K1 and K2
CO2	Interpret the relationship between healthy eating and mind	K1 and K2
CO3	Compose the pros and cons of personal effectiveness	K1, K2 and K3
CO4	Hypothesize the importance of mind	K1, K2 and K3
CO5	Appraise oneself as a biologist	K1, K2 and K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	M	M	M

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



193BT1A3SA	PERSONALITY DEVELOPMENT	SEMESTER III
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Total Credits: 3

Total Instruction Hours: 36 h

### Syllabus

**Unit I** Concept of Good Health 7 h

Personality Development – psychological and physical. Development of soft skills, healthy interpersonal relationship, networking. Healthy and balanced diet and exercise. Classification of food, nutritional value, acceptable dietary intake.

**Unit II** Healthy body creates healthy mind 7 h

Role of nutraceuticals with special reference to diabetes mellitus, hypertension, hypercholesterolemia, cancer. Concept of antioxidants in dietary supplements in prevention and treatment of cancer, obesity and stress. Role of nutraceuticals and functional foods in pediatrics, geriatrics, sports, pregnancy and lactation.

**Unit III** Biological Psychology 7 h

Fundamental issues of biological psychology – mind brain relationship. Biological causes of behavior. Regulation of internal environment – temperature – hunger – thirst – emotions. Biological theories of sleep – stages of sleep and sleep disorder

**Unit IV** Advanced Mental Attitude 7 h

Conquer mental worries – working of brain with regard to emotions – techniques to analyse worries – facts about worries – how to avoid fatigue – dressing sense and attitude – environment and mind – stress related to mental attitude – guilt related to mental attitude.

**Unit V** Transform as a Biologist 8 h

Words to transform your life – think practical – speak logical – causes and consequences of proactiveness – trend of questioning and its benefits. Looking at criticism positively – live goal oriented – positive vibrations and aura




## Text Books

- 1 Carnegie, D. 2018. Art of Public Speaking. 4th edition. Samaria Publishing. India.
- 2 Leggett, B. 2017. 3rd edition. Self Development. Orange Smile Publishing. United States.

## References

- 1 Coelho, P. 2010. 2nd edition. The Alchemist. Harpar Collins Press. United States.
- 2 Shanahan, C. 2019. Deep Nutrition: Why your genes need traditional foods. 2nd edition. St. Martin's Press. United States.
- 3 Carnegine, D. 2017. How to Stop worrying and start living. 3rd edition. Manjula Publishing, India.
- 4 Covey, S. R. 2015. Seven Habits of Highly Effective People. 1st edition, iBookstore special video edition.

		
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193BT1A3GA	GENERIC ELECTIVE: MUSHROOM TECHNOLOGY	SEMESTER III
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Total Credits: 2

Total Instruction Hours: 24 h

### Syllabus

**Unit I** Basic concepts of Mushroom Technology 5 h

Mushroom Technology - Introduction, History and Scope. Edible and Poisonous Mushrooms. Importance and nutritive value of edible mushrooms. Mushroom research centers in India

**Unit II** Types of mushroom and its cultivation 5 h

Cultivation of button mushroom (*Agaricus bisporus*), milky mushroom (*Calocybe indica*), oyster mushroom (*Pleurotus sajorcaju*) and paddy straw mushroom (*Volvvariella volvcea*)

**Unit III** Production, Harvest and Storage methods 5 h

Isolation and culture of spores, culture media preparation. Production of mother spawn, multiplication of spawn - Inoculation Technique

**Unit IV** Cultivation technology 5 h

Substrates, composting technology, bed, polythene bag preparation, spawning - Cropping and its importance

**Unit V** Mushroom production 4 h

Harvest -types and Storage methods and post marketing surveillance and types.

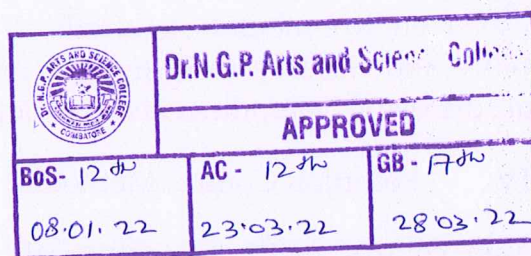


## Text Books

- 1 Krishnamoorthy, A.S et al. 1991. Oyster Mushrooms. 2nd edition. TNAU Department of Plant Pathology. Tamil Nadu
- 2 Suman, B C, and Sharma V P. 2007. Mushroom Cultivation in India. 1st edition. Daya Publishing House. India

## References

- 1 NIIR Board of Consultants and Engineers. 2011. Handbook on Mushroom Cultivation and Processing.1st edition. Asia Pacific Business Press Inc. India
- 2 Biswas S. 2012. Mushrooms: A Manual for Cultivation. 1st edition. PHI Learning Private Limited. New Delhi
- 3 Thapa, C.D et al. 2017. Mushroom Culture. 1st edition. Agrimoon.com.
- 4 Russel, S. 2018. Essential guide to Mushroom Cultivation. 2nd edition. Storey Publishing, United States





193BT1ASSA	SELF STUDY - ENVIRONMENTAL MANAGEMENT	SEMESTER III
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Total Credits: 1

### Syllabus

#### Unit I Ecology and Ecosystem

Ecology - ecosystem and their types - definitions - environmental components and interrelationships - physical, chemical and biological characteristics of environment energy flow and materials cycling.

#### Unit II Pollution

Definition - source of pollution - types of pollution - air, water, soil, noise and radioactive pollution - environmental sanitation - environmental issues - global - national - regional and local

#### Unit III Environmental Standards

Prescribed environmental standards - WHO - Pollution Control Board - risk probability and hazards to humans - toxicology - chemical hazards - biological hazards: disease development and developing countries.

#### Unit IV Pollution Control Methods

Pollution control methods - physical, chemical and biological - waste water treatment - activated sludge process, oxidation ponds and trickling filter - anaerobic process.

#### Unit V Environmental Management

Tool for environment management - Environmental Impact Assessment - waste minimization techniques - environmental planning in urban development - natural resources and sustainable development - environmental ethics.

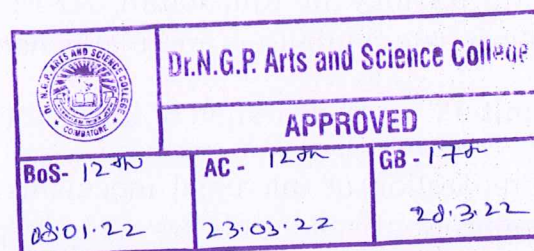


## Text Books

- 1 Joseph, K. and Nagendra, R. 2004. Essentials of Environmental Studies. 2nd edition. Pearson Education. New Delhi
- 2 Tyler, M.J.R. 2004. Environmental Science. 2nd edition. Thomson Brooks/Cole Publishing. Singapore.

## References

- 1 Dhamejam, S.K. 2005. Environmental Science and Engineering. 2nd edition. Kataria sons. Delhi
- 2 Dubey, R.C. 2006. Environmental Health Ecological Perspectives. 3rd edition. Jones and Bartlett Publishers. USA
- 3 Dash, M.C. 1998. Fundamentals of Ecology. 2nd edition. Tata McGraw Hill. India .
- 4 Scragg, A. 2007. Environmental biotechnology. 2nd edition. Oxford university press. India.





193BT1ASSB	SELF STUDY - BIOFERTILIZER TECHNOLOGY	SEMESTER III
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Total Credits: 1

### Syllabus

#### Unit I Introduction to Biofertilizers

An introduction to fertilizers, synthetic fertilizers, natural fertilizers, inorganic fertilizers, organic fertilizers, bio-fertilizers - importance, advantages and constraints.

#### Unit II Culturing Methods

Isolation, culturing methods, enumeration and identification of microbial species - Rhizobium, Azospirillum Azotobacters, blue green algae and phosphate solubilisers.

#### Unit III Rhizobium

Morphology of Rhizobium, Azospirillum, Azotobacters, blue green algae and phosphate solubilisers and maintenance - inoculant preparation.

#### Unit IV Preparation of Inoculants

Preparation of microbial inoculants - large-scale production of microbes - their application as biofertilizers - crop responses to biofertilizers

#### Unit V Algae and Biofertilizers

Azolla - distribution, morphological and biochemical characteristics - cyanobacterial symbionts - azolla biofertilizer technology - organic matter and composting - method of processes, applications and limitations




## Text Books

- 1 Rao, N.S. 2000. Biofertilizers in Agriculture. 2nd edition. Oxford & IBH publishing Co. New Delhi
- 2 Sundararaj, D.D. and Thulasidas, G. 1993. Botany of Field Crops. 2nd edition. McMillan India Ltd. India

## References

- 1 Jeswani, L.M. and Baldev, B. 1990. Advances in Pulse Production Technology. 1st edition. ICAR. New Delhi..
- 2 Malsen, L.J.G.V. and S. Somaatmadja. 1993. PROSEA - Plant Resources of South East Asia. No.1. Pulses. 2nd edition. International Book Distributors, Dehradun.
- 3 Prohit, S.S. 2003. Ecology and environment and pollution. 1st edition. Agrobios publications. India
- 4 Varma. P.S. 1998. Concept of ecology. 1st edition. Chand & Co Ltd. India .

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191TL1A3AA	பகுதி - 4 : அடிப்படைத்தமிழ்தாள் : 1(Basic Tamil )	SEMESTER III
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Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019-20ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது (10 மற்றும் 12 - ஆம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயிலாதவர்களுக்கு) (பருவத் தேர்வு உண்டு)

அலகு : 1 தமிழ் மொழியின் அடிப்படைக் கூறுகள் 12 h

அ) எழுத்துகள் அறிமுகம் :

1. உயிர் எழுத்துக்கள் - குறில் , நெடில் எழுத்துகள்
2. மெய் எழுத்துக்கள் - வல்லினம், மெல்லினம், இடையினம்
3. உயிர்மெய் எழுத்துக்கள்

ஆ) சொற்களின் அறிமுகம்: பெயர்ச்சொல், வினைச்சொல் - விளக்கம் (எ.கா.)

அலகு : 2 குறிப்பு எழுதுதல் 12 h

1. பெயர், முகவரி, பாடப்பிரிவு , கல்லூரியின் முகவரி
2. தமிழ் மாதங்கள்(12), வாரநாட்கள்(7),
3. எண்கள் (ஒன்று முதல் பத்து வரை), வடிவங்கள், வண்ணங்கள்
4. ஊர்வன, பறப்பன, விலங்குகள், மனிதர்களின் உறவுப்பெயர்கள்
5. ஊர்களின்பெயர்கள் (எண்ணிக்கை 10)
6. பயிற்சிப் பகுதி (உரையாடும் இடங்கள்) : வகுப்பறை, பேருந்து நிலையம், சந்தை

வினாத்தாள் அமைப்பு முறை -

மொத்த மதிப்பெண்கள் - 100

பகுதி -அ

சரியான விடையைத் தேர்வு செய்தல்

10x2=20

பகுதி -ஆ

சரியா? தவறா? தேர்ந்தெடுத்து எழுதுக .

10x2=20

பகுதி-இ

ஒரு பக்க அளவில் விடையளிக்க

03x20=60

குறிப்பு:

- அனைத்து அலகுகளில் இருந்தும் வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ-க்கான வினாக்கள் இது அல்லது அது என்ற அடிப்படையில் அந்தந்த அலகுகளில் அமைதல் வேண்டும்



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

## Text Books

- 1 அடிப்படைத் தமிழ். 2019. தொகுப்பு : தமிழ்த் துறை, டாக்டர் என். ஜி.பி. கலை மற்றும் அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி)லிட். சென்னை

## References

- 1 ஒன்றாம் வகுப்பு பாடநூல் - தமிழ்நாடு அரசு பாடநூல் கழகம்
- 2 வலைதள முகவரி : <http://tamilvu.org>

		
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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



191TL1A3AB	பகுதி - 4 : சிறப்புத் தமிழ் தாள் : 1 (Advanced Tamil)	SEMESTER - III
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Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019- 2020 ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது (10 மற்றும் 12 - ஆம் வகுப்புகளில் தமிழ் மொழிப்பாடம் பயின்றவர்களுக்கு உரியது)(பருவத் தேர்வு உண்டு)

அலகு - 1 மரபுக் கவிதைகள்

05 h

அ) பாரதியார் கவிதைகள்

- தமிழ்நாடு
- மனதில் உறுதி வேண்டும்
- வருகின்ற பாரதம் (பா.எண்.5-8)

ஆ) பாரதிதாசன் கவிதைகள்

- இன்பத்தமிழ்
- நீங்களே சொல்லுங்கள்
- வாளினை எட்டா!

இ) தாராபாரதி கவிதைகள்

- வேலைகளல்ல வேள்விகள்

அலகு - 2 புதுக்கவிதைகள்

05 h

- கம்பன் கவியரங்கக் கவிதை - மு.மேத்தா
- தமிழா! நீ பேசுவது தமிழா! - காசியானந்தன்
- நட்புக் காலம் (10 கவிதைகள்) - அறிவுமதி கவிதைகள்

அலகு - 3 இலக்கணம்

04 h

- வல்லினம் மிகும் மற்றும் மிகா இடங்கள்
- ர, ற, ல, ழ, ள - ந, ண, ன - ஒலிப்பு நெறி, பொருள் வேறுபாடு அறிதல்

அலகு - 4 கடிதங்கள் எழுதுதல்

05 h

- பாராட்டுக் கடிதம்
- நன்றிக் கடிதம்
- அழைப்புக் கடிதம்
- அலுவலக விண்ணப்பங்கள்

அலகு - 5 பாடம் தழுவிய வரலாறு

05 h

- பாரதியாரின் இலக்கியப் பணி
- பாரதிதாசனின் இலக்கியப்பணி

புதுக்கவிதை, புதுக்கவிதை - விளக்கம்



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வினாத்தாள் அமைப்பு முறை -

மொத்த மதிப்பெண்கள் - 100

சரியான விடையைத் தேர்வு செய்தல்	பகுதி -அ	10x2=20
கோடிட்ட இடங்களை நிரப்புக.	பகுதி -ஆ	10x2=20
இரண்டு பக்க அளவில் விடையளிக்க	பகுதி -இ	4x15=60

குறிப்பு:


- பகுதி -அ அனைத்து அலகுகளில் இருந்தும் இரண்டு வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ -க்கான வினாக்கள் இது அல்லது அது என்ற அடிப்படையில் அந்தந்த அலகுகளில் அமைதல் வேண்டும்

#### Text Books

- 1 சிறப்புத் தமிழ் . 2019. தொகுப்பு: தமிழ்த் துறை, டாக்டர் என். ஜி.பி. கலை மற்றும் அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக ஹவுஸ்(பி)லிட். சென்னை

#### References

- 1 புலவர் சோம. இளவரசு - 2014. இலக்கிய வரலாறு, மணிவாசகர் பதிப்பகம், சென்னை - 108
- 2 வலைதள முகவரி : <http://tamilvu.org>

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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



195CR1A3AA	WOMEN'S RIGHTS	SEMESTER III
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Total Credits: 2

Total Instruction Hours: 24h

### Syllabus

#### Unit I Rights to Infant & Child 4 h

Issues for women in India- Law relating to Female infanticide-Rights to the survival of a child-Child Labour- Child trafficking -Child Marriage- Protection of Children against Sexual Offences Act 2012 (POCSO)

#### Unit II Rights to women 5 h

Matrimonial protection-Protection against dowry-Protection to pregnancy-Sexual offences-Law relating to work Place- Directive principles of Constitution (Article 39 a, d, e & Article 42, 43 & 46) - Trafficking of women

#### Unit III Laws for Senior Citizen women 5 h

Constitutional Rights -Personal Laws- The Tamil Nadu Maintenance and Welfare of Parents and Senior Citizens Rules in 2009- The National Council for Older person- Government Provisions for elderly persons

#### Unit IV Civil and Political Rights of Women 5 h

Right of inheritance-Right to live with decency and dignity-The Married women's Property Act 1874-Personal law women's right to property-Women Reservation Bill-National Commission for Women-Political participation Pre independent political participation of women-Participation of Women in post independent period

#### Unit V International convention on Womens' Right 5 h

Convention on the Elimination of All Forms of Discrimination against Women(CEDAW)-United Nations population Fund(UNFPA)-Protocol to the African Charter on the rights of women in Africa-Convention on the Nationality of Married women-Convention on the political rights of women- Inter-American convention on granting of civil and political rights for women-Universal declaration of Human rights

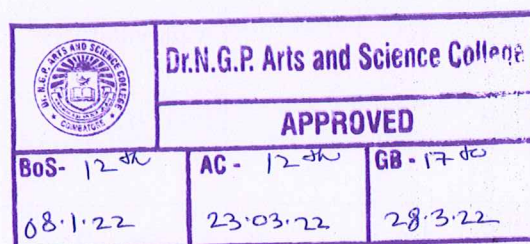


## Text Books

- 1 Women & Law(2009)-Krishna Pal Malik-Allahabad Law University, Delhi

## References

- 1 Women's Human Rights in India(2019)-Christian Foster and Jaya Sagade- Routledge India  
Justice for Women: Concerns and Expressions (2008)-Anand AS –Universal Law  
Publishing Co.



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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
Part - I										
191TL1A4TA	Language - I	Tamil-IV	3	1	-	3	25	75	100	3
191TL1A4HA		Hindi-IV								
191TL1A4MA		Malayalam-IV								
191TL1A4FA		French - IV								
Part - II										
191EL1A4EA	Language - II	English - IV	3	-	1	3	25	75	100	3
Part - III										
193BT1A4CA	Core VII	Immunology	3	1	-	3	25	75	100	3
193BT1A4CB	Core VIII	Bioinformatics	3	-	-	3	25	75	100	3
193BT1A4CP	Core Practical IV	Immunology& Bioinformatics	-	-	4	6	40	60	100	2
192PY1A4IA	IDC - IV	Biophysics	4	-	-	3	25	75	100	4
193BT1A4SA	SEC - II	Biotechniques	3	-	-	3	25	75	100	3
193BT1A4GA	GE - II	Apiculture	2	-	-	3	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A4AA	AECC IV	Basic Tamil	2	-	-	3	-	50	50	2
191TL1A4AB		Advanced Tamil								
192PY1A4AA		General Awareness								
Total			23	2	5	-	-	-	800	25



Course Code	Course Name	Category	L	T	P	Credit
191TL1A4TA	பகுதி-1: தமிழ் - தாள்- IV	மொழி	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- மொழிப்பாடங்களின் வாயிலாகத் தமிழரின் பண்பாடு , பகுத்தறிவு ஆகியவற்றை அறியச் செய்தல்
- கலை மற்றும் மரபுகளை அறியச் செய்தல்
- மாணவர்களின் படைப்பாக்கத்திறன்களை ஊக்குவித்தல்

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	வாழ்க்கைத்திறன்கள் (Life Skills) – மாணவனின் செயலாக்கத்திறனை ஊக்குவித்தல்	K1,K2 & K3
CO2	மதிப்புக்கல்வி (Attitude and Value education)	K2,K4
CO3	பாட இணைச்செயல்பாடுகள் (Co-curricular activities)	K2,K3 & K4
CO4	சூழலியல் ஆக்கம் (Ecology)	K4
CO5	மொழி அறிவு (Tamil knowledge)	K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong

M Medium

L Low



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191TLIA4TA	பகுதி-1: தமிழ் - தாள்- IV	SEMESTER IV
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Total Credits: 3

Total Instruction Hours: 48 h

## Syllabus

Unit I எட்டுத்தொகை 10 h

1. இலக்கிய வரலாறு - எட்டுத்தொகை நூல்கள்

2. நற்றிணை - குறிஞ்சித் திணை

I.பா.எண் : 01 - கபிலர்

II.பா.எண் : 88 - நல்லந்துவனார்

III.பா.எண் : 102 - செம்பியனார்

2. குறுந்தொகை - முல்லைத்திணை

I.பா.எண் : 65 - கோவூர்கிழார்

II. பா.எண் : 167 - கூடலூர்கிழார்

மருதத்திணை

I.பா.எண் : 08 - ஆலங்குடி வங்கனார்

II.பா.எண் : 61 - தும்பிசேர்கீரனார்

III.பா.எண் : 196 - மிளைக் கந்தன்

நெய்தல் திணை

I.பா.எண் : 57 - சிறைக்குடி ஆந்தையார்

Unit II எட்டுத்தொகை 08 h

1. கலித்தொகை - பாலைக்கலி

I.பா.எண் : 9 - பெருங்கடுங்கோ

2. அகநானூறு - மருதத்திணை

I.பா.எண் : 86 - நல்லாவூர்கிழார்

குறிஞ்சித் திணை

I.பா.எண் : 198 - பரணர்

2. புறநானூறு -

I.பா.எண் : 188 - பாண்டியன் அறிவுடை நம்பி

II.பா.எண் : 192 - கணியன் பூங்குன்றனார்

III.பா.எண் : 279 - ஒக்கூர் மாசாத்தியார்

IV.பா.எண் : 312 - பொன்முடியார்



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### Unit III பத்துப்பாட்டு

10 h

1. இலக்கிய வரலாறு - பத்துப்பாட்டு நூல்கள்
2. பட்டினப் பாலை - கடியலூர் உருத்திரங் கண்ணனார்

### Unit IV புதினம்

10 h

1. புதினத்தின் தோற்றமும் வளர்ச்சியும்
2. புதினம்
  1. புத்துமண் - சுப்ரபாரதிமணியன்

### Unit V இலக்கணம் மற்றும் திறனாய்வுப் பகுதி

10 h

#### I. இலக்கணம்

1. அகத்திணை - அன்பின் ஐந்திணை - விளக்கம்
2. புறத்திணை - 12 திணைகள் - விளக்கம்

#### II. பயிற்சிப் பகுதி

புதினத் திறனாய்வு - கொங்கு வட்டாரப் புதினங்கள்

1. நாகம்மாள் - ஆர். சண்முகசுந்தரம்
2. மானாவாரி மனிதர்கள் - சூர்யகாந்தன்
3. ஈரம் கசிந்த நிலம் - சி. ஆர். ரவீந்திரன்
4. ஒண்டிக்காரன் பண்ணையம் - மா. நடராசன்

**Note:** பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

### Text Books

- செய்யுள் திரட்டு - மொழிப் பாடம் - 2020- 21
- 1 தொகுப்பு: தமிழ்த்துறை, டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி, வெளியீடு : நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை - 600 098.
- 2 சுப்ரபாரதிமணியன், முதற் பதிப்பு -2019, புத்துமண் புதினம் - நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை - 600 098. (Unit-IV)


### References

- 1 பேராசிரியர் புலவர் சோம . இளவரசு, எட்டாம் பதிப்பு -2014, தமிழ் இலக்கிய வரலாறு - மணிவாசகர் பதிப்பகம், சென்னை - 600 108.
- 2 பேராசிரியர் முனைவர் பாக்கியமேரி , முதற் பதிப்பு -2013, இலக்கணம் - இலக்கிய வரலாறு - மொழித்திறன் -பூவேந்தன் பதிப்பகம், சென்னை-600 004.
- 3 தமிழ் இணையக் கல்விக்கழகம். <http://www.tamilvu.org/>



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B.Sc. Biotechnology (Students admitted during the AY-2021-22)



Course Code	Course Name	Category	L	T	P	Credit
191TL1A4HA	Part- I : HINDI - Paper-IV	Language	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

191TL1A4HA	Part- I : HINDI - Paper-IV	SEMESTER IV
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Total Credits: 03

Total Instruction Hours: 48 h

## Syllabus

## Unit I

10 h

नाटक - लडाई - सर्वेश्वरदयाल सक्सेना

प्रकाशक: वाणी प्रकाशन

21-A, दरियागंज

नई दिल्ली-110002

## Unit II

10 h

एकांकी: एकांकी पंचामृत - डॉ राम कुमार

(भोर और तारा छोड़कर)

प्रकाशक: जवाहर पुस्तकालय

सदर बाजार, मथुरा

उत्तर प्रदेश-281001

## Unit III

10 h

काव्य मंजरी- (डा मुन्ना तिवारी)

मैथिलीशरण गुप्त- मनुष्यता, जयशंकर प्रसाद- बीती विभावरी जागरी

सूर्यकान्त त्रिपाठी निराला- तोडती पत्थर और भिक्षुक

## Unit IV

10 h

सूचना लेखन

पुस्तक: व्याकरण प्रदिप - रामदेव

प्रकाशक: हिन्दी भवन 36 इलाहाबाद-211024


## Unit V

08 h

अनुवाद अभ्यास-III (केवल अंग्रेजी से हिन्दी में)

(पाठ 10 to 20)

प्रकाशक: दक्षिण भारत प्रचार सभा चेन्नई -17

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Course Code	Course Name	Category	L	T	P	Credit
191TL1A4MA	Part- I : MALAYALAM - Paper-IV	Language	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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191TL1A4MA	Part- I : MALAYALAM - Paper-IV	SEMESTER IV
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Total Credits: 3


Total Instruction Hours: 48 h

### Syllabus

Unit I	10 h
Drama	
Unit II	10 h
Drama	
Unit III	10 h
Drama	
Unit IV	10 h
Screen Play	
Unit V	08 h
Screen Play	

### Text Books

- 1 Manju Poloru Penkuty, Screen Play By Kalavoor Ravikumar, Published by DC.Books, Kannur.
- 2 Lankalakshmi, Drama By C.N.Sreekandan Nair Published by D C.Books Kottayam

		
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Course Code	Course Name	Category	L	T	P	Credit
191TL1A4FA	Part- I : FRENCH- Paper-IV	Language	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To Acquire Competence in General Communication Skills – Oral + Written – Comprehension & Expression.
- To Introduce the Culture, life style and the civilization aspects of the French people as well as of France.

To help the students to acquire Competency in translating simple French sentences into English and vice versa.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents	K1
CO2	To learn the adjectives and the classroom environment in France	K2
CO3	Learn the Plural, Articles and the Hobbies.	K3
CO4	To learn the Cultural Activity in France	K3
CO5	To learn the Sentiments, life style of the French people and the usage of the conditional tense	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong

M Medium

L Low



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191TL1A4FA	Part- I : FRENCH- Paper-IV	SEMESTER IV
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Cœur et santé

10 h

<ul style="list-style-type: none"> <li>• Author du Couple</li> </ul>	<ul style="list-style-type: none"> <li>• INTERACTION ORALE: Exprimer son intérêt pour quelqu'un, exprimer l'affection</li> <li>• RECEPTION ORALE: Comprendre une chanson</li> <li>• RECEPTION ÉCRITE: Lire un horoscope</li> <li>• PRODUCTION ÉCRITE: Écrire une letter au courrier du cœur</li> </ul>	<ul style="list-style-type: none"> <li>• J'étais...L'imparfait(1)</li> <li>• Aussi brillant que...</li> <li>• Le plus beau, le moins cher</li> <li>• Le verbe connaître</li> </ul>
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#### Unit II Problèmes problems

10 h

<ul style="list-style-type: none"> <li>• Le bénévolat</li> </ul>	<ul style="list-style-type: none"> <li>• INTERACTION ORALE: Interroger sur la tristesse, l'abattement, exprimer sa sympathie, rassurer</li> <li>• RÉCEPTION ORALE: Comprendre une interview à la radio</li> <li>• RECEPTION ÉCRITE: Comprendre un test de magazine</li> <li>• PRODUCTION ÉCRITE: Écrire une letter a un(e) amie</li> </ul>	<ul style="list-style-type: none"> <li>• Les pronoms indfinis rien, quelque chose</li> <li>• Le verbe crier</li> <li>• Du pluriel: eau, eu, al</li> <li>• Se soigner, s'excuser, se renseigner, s'appeler</li> <li>• La phrase ngative: ne... plus, ne... jamais, ne... rien, ne... personne</li> </ul>
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## Unit III C'est qui? C'est comment?

10 h

<ul style="list-style-type: none"> <li>• Les classes sociales</li> </ul>	<p>INTERACTION ORALE: Décrire quelqu'un</p> <p>RECEPTION ORALE: Comprendre un bulletin météo</p> <p>RECEPTION ÉCRITE: Comprendre une courte interview</p> <p>PRODUCTION ÉCRITE: Écrire des notices biographiques</p>	<ul style="list-style-type: none"> <li>• Les adjectifs qualificatifs: Formes au masculin et au féminin</li> <li>• Il fait beau, il neige, il pleut...</li> <li>• Le verbe décrire</li> <li>• Les verbes en -indre</li> <li>• Les adjectifs possessifs féminins mon, ton, son devant voyelle ou h</li> </ul>
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## Unit IV Et après? Et après

10 h

<ul style="list-style-type: none"> <li>• La mémoire et l'histoire</li> </ul>	<ul style="list-style-type: none"> <li>• INTERACTION ORALE: Raconter une anecdote, une histoire, attirer l'attention</li> <li>• RÉCEPTION ORALE: Comprendre une interview à la radio</li> <li>• RÉCEPTION ÉCRITE: Comprendre des faits divers</li> <li>• PRODUCTION ÉCRITE: Écrire une brève</li> </ul>	<ul style="list-style-type: none"> <li>• L'imparfait(2)</li> <li>• Les verbes en -oir</li> <li>• Les pronoms démonstratifs ça et cela</li> <li>• Prés de... Loin de...</li> <li>• La forme passive</li> </ul>
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## Unit V Dialogue writing

08 h

<ul style="list-style-type: none"> <li>a) Les Courses</li> <li>b) A La Banque</li> <li>c) Ecole</li> <li>d) Professions</li> <li>e) Bijoux</li> </ul>
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## Text Books

- 1 *Marcella Di Giura Jean-Claude Beacco, Alors II. Pages 88 - 162, Goyal Publishers Pvt Ltd 86, University Block ,Jawahar Nagar (Kamla Nagar), New Delhi - 110007.*
- 2 *French Made Easy by Rashmi Varma, Goodwill Publishing House, New Delhi - 110 008.*

		
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Course Code	Course Name	Category	L	T	P	Credit
191EL1A4EA	ENGLISH- IV	LANGUAGE	4	-	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The basics of English grammar and specific usages
- The importance of the vocabulary and use in different contexts
- The necessity of communication and composition writing skills

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn English grammar and its specific usage	K2
CO2	Know the ways of improving English language vocabulary	K3
CO3	Understand the importance of English language in competitive exams	K3
CO4	Acquire the basic needs of communication skills and methods	K3
CO5	Comprehend the composition writing and similar skills	K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	S	S	M	M	S
CO3	S	S	S	M	M
CO4	S	M	M	S	S
CO5	M	S	M	S	S

S Strong

M Medium

L Low



191EL1A4EA	ENGLISH- IV	SEMESTER IV
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**Total Credits: 3**

**Total Instruction Hours: 48 h**

### Syllabus

**Unit I** Grammar 10 h

The use of correlatives - The perfect tense - appended questions - the infinitive - negative verbs - redundant conjunctions - use of make and do - fairly and rather

**Unit II** Vocabulary 10 h

Words and contextual uses - Synonyms - Antonyms - Add one out - inflectional - infix- telescoping - loanwords - British and American words - Thesaurus

**Unit III** Language Use 08 h

Spotting Errors - Words often confused - Reconstructing a Passage - Clause - Idioms and colloquialism - Language aptitude - Clipping

**Unit IV** Communication 11 h

Different Types of Asking - Oral rehearsal - Describing person, Diagram, Data, Table - Vote of thanks - Small talk - Refusal and Apology

**Unit V** Composition 09 h

General Essay writing - Mind map - Reviews - Title expansion - Creative writing - Content writing - Translation - Abstracting - Flash Fiction






## Text Books

- 1 Wood F.T. 2010. A Remedial Grammar for Foreign Students. Macmillan Publishers, India. [Unit I and II]
- 2 Bhatnagar R.P. 2013. English for Competitive Examinations. 3rd Edition. Trinity Press, New Delhi. [Unit III, IV and V]

## References

- 1 Radhakrishna Pillai G. 2000. English for Success. Emerald Publishers, Chennai.
- 2 Krishnaswamy N. 2000. Modern English a Book of Grammar Usage and Composition. Macmillan Publishers, India.
- 3 Arulselvi Evangelin. 2012. Teaching of Special English. Saratha Pathippagam, Chennai.
- 4 Rawdon Wyatt. 2008. Check Your Vocabulary for TOFEL. Macmillan Publishers, India.

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08.01.22	23.3.22	28.3.22



Course Code	Course Name	Category	L	T	P	Credit
193BT1A4CA	IMMUNOLOGY	CORE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- the cells of immune system
- the different techniques in immunology.
- the applications of immune techniques.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts in immunology	K1
CO2	Learn basics of Immune Response and Transplantation Technology	K1, K2
CO3	Discuss and distinguish different antigen antibody interactions, Allergic reactions and Tumour immunology	K1,K2,K3
CO4	Learn about different antibody production techniques	K1,K2,K3
CO5	Awareness on types of vaccines and its significance	K1,K2,K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	M	M	S	S	S
CO5	M	S	S	S	S

S Strong

M Medium

L Low





193BT1A4CA	IMMUNOLOGY	SEMESTER IV
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**Total Credits: 3**

**Total Instruction Hours: 48 h**

### Syllabus

**Unit I** Basic concepts of Immunology 10 h

History and scope of immunology - types of immunity - primary and secondary lymphoid organs - immunoglobulin structure - function and synthesis; memory cells, idiotypic network, lymphocyte differentiation.

**Unit II** Types of immune response 10 h

Complement systems - structure and function of MHC class I and II molecules - antigen recognition and presentation - Humoral and Cell mediated immune responses - immune suppression and immune tolerance - Transplantation immunology- Graft rejection.

**Unit III** Hypersensitivity and Tumor immunology 10 h

Antigen- antibody reaction, Hypersensitivity - IgE mediated, antibody mediated, immune complex mediated and delayed type hypersensitivity. Tumor immunology- tumor associated antigens, Immune response to tumor. Auto immune disorders.

**Unit IV** New Generation Antibodies 09 h

Hybridoma and monoclonal antibody production, immune diagnosis and applications - human monoclonal antibodies, catalytical antibodies - complement fixation - assessment of immune complexes in tissues.

**Unit V** Vaccinology 09 h

Vaccines- Immunization types- Vaccine types- live attenuated vaccines, killed vaccines and purified polysaccharide vaccines- toxoid vaccines - recombinant vaccines and DNA vaccines.




## Text Books

- 1 Kuby J, 2003, "Immunology ", 5th edition, W.H. Freeman and Company, New York.
- 2 Rao CV, 2002, "Textbook of Immunology", 1st edition, Narosa Publishing House, India

## References

- 1 Riot I, 1988, "Essentials of Immunology", 6th edition, Blackwell Scientific Publications, USA.
- 2 Tizard A, 1995, "Immunology ", 4th edition, Saunders college publishers, USA.
- 3 Ramesh, 2016, "Immunology", 1st edition, McGraw Hill Education, India Private Limited.
- 4 Ed Harlow, David Lane, 1988, "Antibodies Laboratory Manual", Cold Spring Harbor Laboratory Press, USA.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A4CB	BIOINFORMATICS	CORE	3	-	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- biological databases and their applications.
- the applications of various tools.
- biology better in terms of computer algorithms.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Insight on storage and retrieval of data	K1
CO2	Understanding biological databases with applications	K1, K2
CO3	Discuss and distinguish the types of protein structures and its implications in function	K2, K3
CO4	Explain the sequences and its alignment which determines several roles of biomolecules	K2, K3
CO5	Comprehend the molecular modelling and visualization for drug designing	K1, K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	M

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

193BT1A4CB	BIOINFORMATICS	SEMESTER IV
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Total Credits: 3

Total Instruction Hours: 36 h

### Syllabus

**Unit I** Introduction to Bioinformatics 8 h

Big Data – Biological data. Retrieval of information. Evolution of Bioinformatics – history, scope and applications. Internet- World wide web - search engines, Entrez, PubMed. Commercial softwares used for biological information

**Unit II** Biological databases 7 h

Types. Nucleic acid databases (NCBI, EMBL, DDBJ), protein databases (PDB, Expasy, Swiss Prot, Prosite), specialized databases, model organism databases. Phylogenetic trees - evolutionary relationship using PHYLIP

**Unit III** Protein structures 7 h

Physical properties – structural and sequence database for proteins – CATH, SCOP, FSSP – fold classification based on structure. Primary, secondary, tertiary, super secondary structures of proteins. Structure and functional relationship of proteins

**Unit IV** Sequence Alignment and Genomics 7 h

Introduction to sequence alignments and dynamic programming: Local alignment, global alignment, pairwise and multiple alignment. FASTA – characteristics, BLAST and its types. Gene expression analysis – cDNA microarray. EST databases (DBEST, UNIGENE).

**Unit V** Docking 7 h

Docking – Principle, steps. Lead compound, protein target. Computer Aided Drug Designing– applications. High throughput screening– working and applications. Molecular modelling and visualization. QSAR. Human Genome project.






## Text Books

- 1 Shanmughavel P, 2006, "Trends in Bioinformatics", Pointer Publishers, Jaipur, India.
- 2 Lesk AM, 2003, "Introduction to Bioinformatics", Oxford University Press, New Delhi.

## References

- 1 Andrew R Leach, 2001, "Molecular Modeling: Principles and Application", Pearson Publishers, United Kingdom.
- 2 Hans X, 2008, "Basic principles and applications", Wiley publications, United States
- 3 Yvonne C Martin, 1998, "Designing bioactive molecules three-dimensional techniques and applications", American Chemical Society, United States
- 4 Leo, Albert, Hockma, Hansch, Corwin, 1995, "Exploring QSAR", 2nd edition, American Chemical Society, United States.

		
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08.1.22	23.03.22	28.3.22



193BT1A4CP	<b>CORE PRACTICAL IV: IMMUNOLOGY &amp; BIOINFORMATICS</b>	<b>SEMESTER IV</b>
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**Total Credits: 2**

**Total Instructions Hours: 48 h**

<b>S.No</b>	<b>List of Experiments</b>
1	Blood grouping and Rhtyping *
2	Preparation of Serum
3	Precipitin ringtest
4	Single Radial Immunodiffusion
5	Double Radial Immunodiffusion
6	Immunoelectrophoresis
7	Rocket Immunoelectrophoresis
8	Retrieving data from Biological Databases.*
9	Retrieving articles with filter criteria (PubMed)
10	Pairwise alignment using BLAST.
11	Construction of phylogenetic trees.
12	Visualization of protein structures and interpretation.

**Note:** Any 10 out of 12 experiments will be carried out. DBT STAR College Scheme Experiments \*



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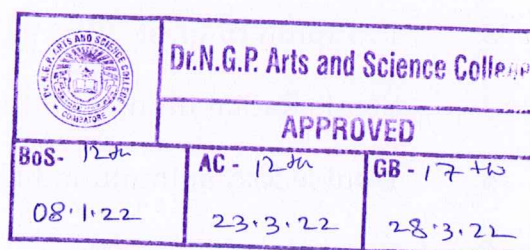
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## References

- 1 Ivan Lefkovits, 1996, "Immunology Methods Manual: The Comprehensive Sourcebook of Techniques", 1st edition, Academic Press Inc, United States.
- 2 Jack Bradshaw L, 1995, "Laboratory Immunology", 2nd Edition, Saunders College Publishing, United States.
- 3 Agostino, Michael J, 2013, "Practical Bioinformatics", 1st Edition, Garland Science Publishers, United States.
- 4 Iftekhar M and Ghalib M, 2015, "Bioinformatics Practical Manual: Sequencing Practical", Biocuration Labs, Bangalore.



Course Code	Course Name	Category	L	T	P	Credit
192PY1A4IA	BIOPHYSICS	IDC	4	-	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- To study the application of physics to biological systems
- To learn the concepts and techniques of biophysics
- To find the applications of biophysics in molecular studies and medicine

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn basic of Molecular Biophysics	K1
CO2	Understand the Membrane Biophysics, Physical Properties of membrane and Membrane potentials	K1, K2
CO3	Know the biophysical techniques applied in understating biomolecules	K1, K2
CO4	Learn about Neurobiophysics; Nervous System, Visionary System and Hearing System	K1, K2, K3
CO5	Know the Role of Radiation Physics in applied medical diagnosis & treatment	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	M
CO3	M	M	S	S	S
CO4	S	S	M	S	S
CO5	M	S	S	S	S

S                      Strong                      M                      Medium                      L                      Low





192PY1A4IA	BIOPHYSICS	SEMESTER IV
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Introduction to Biophysics 10 h

Introduction - Molecular Biophysics; Thermodynamics of Biological system: First and second laws of thermodynamics, activation energy. Bioenergetics: Basic concept of energy coupling reactions in biological processors, Energy requirements in cell metabolism, high energy bonds, energy currency of cell.

#### Unit II Membrane Biophysics 10 h

Physical Properties of membrane: Elastic properties, Elastic constants, Charge-induced microstructures and domain. Membrane melting. Membrane potentials: Cell surface charge, Resting membrane potential, Action potential, Membrane impedance and capacitance, Transmembrane potential, total electrochemical potential.

#### Unit III Biophysical Techniques and Methods 9 h

Introduction to Light: Reflection, Refraction, Diffraction, Interference phenomena, Refractometry: Refraction of light and Snell's law, refractive index, principle, design, working and application of Abbe's refractometer. Polarimetry, Viscometry, Static Scattering Techniques, Dynamic Scattering Techniques, X-Ray Diffraction and Molecular Structure, Optical Tweezers, Patch Clamping, Molecular Dynamics, Potential Energy Contour Tracing.

#### Unit IV Neurobiophysics 9 h

Introduction: The Nervous System; Synapse, Physics of Membrane Potentials, Membrane potential due to diffusion, Voltage Clamp, Sensory Mechanisms -The Eye; The visual receptor, Electrical activity and visual generator potentials, Neural aspects of vision, Visual communications, Physical Aspects of Hearing - The Ear; Elementary acoustics, Theories of hearing.

#### Unit V Radiation & Medical Biophysics 10 h

Basics of Radiation Physics: Isotopes, Isobars, Isotones, Isomers, Radioactivity, General properties of alpha, beta and gamma radiations, Radiation units. Radiolysis of water, Production of free radicals & their interactions, Radiation chemical yield and G value, Target theory, Single hit & Multi hit theory, Effect of



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radiation on Nucleic acids, Proteins, Enzymes. Radioisotopes in biology, Medicine (Therapy & diagnosis), Agriculture, Biological applications of radioisotope, Radio-labeling & Tracer techniques, Radiation sterilization of medical product.

### Text Books

- 1 VasanthaPattabhi , Gautham N, 2002, "Biophysics", 1st Edition, Kluwer Academic Publishers , United States
- 2 Rodney MJ, Cotterill, 2002, "Biophysics: An Introduction", 2nd edition, John Wiley & Sons Ltd, United States

### References

- 1 Tom A Waigh, 2007, "Applied Biophysics- A Molecular Approach for Physical Scientists" , 1st edition, John Wiley & Sons Ltd, United States
- 2 Jay L Nadeau, 2018, "Introduction to Experimental Biophysics Biological Methods for Physical Scientists", 2nd Edition, CRC Press, United States.
- 3 Glaser, Roland, 1999, "Biophysics", 1st edition, Springer-Verlag Berlin, Heidelberg.
- 4 Parke, William C, 2020, "Biophysics: A Student's Guide to the Physics of the Life Sciences and Medicine", 1st edition, Springer International Publishing, United States

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A4SA	BIOTECHNIQUES	SEC	3	-	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- the function and application of several common measurement systems used in Biotechnology.
- the technical vocabulary associated with instrumentation.
- To design and basic signal analysis.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the Principle and the types of Centrifugation	K2, K3
CO2	Classifying the chromatographic techniques and analyzing its applications	K2, K3
CO3	Imparts knowledge on the Electrophoresis and Blotting Techniques	K3, K4, K5
CO4	Focus on Spectroscopic Techniques and it's applications	K4, K5
CO5	In depth understanding of Radio-isotopic Techniques and its applications	K4, K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong

M Medium

L Low



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193BT1A4SA	BIOTECHNIQUES	SEMESTER IV
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Total Credits: 3

Total Instruction Hours: 36 h

### Syllabus

#### Unit I Centrifugation 7 h

Sedimentation Principle, Types of rotors, Preparative and Analytical Centrifuges, Density Gradient Centrifugation, Differential centrifugation.

#### Unit II Chromatography Techniques 7 h

Theory and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC.

#### Unit III Electrophoresis Techniques 7 h

Theory and Application of PAGE, Agarose Gel Electrophoresis, 2D gel electrophoresis, Iso-electric Focusing, Immuno diffusion, Immuno Electrophoresis, ELISA, RIA, Southern, Northern and Western Blotting.

#### Unit IV Spectroscopic Techniques 7 h

Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, MS, NMR, ESR, Atomic Absorption Spectroscopy.

#### Unit V Radio-isotopic Techniques 8 h

Introduction to Radioisotopes and their Biological Applications, Radioactive Decay - Types and Measurement, Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography.






## Text Books

- 1 Sawhney SK & Randhir S, 2006, "Introductory Practical Biochemistry", 3rd edition, Narosa publishing House, India.
- 2 Boyer, Rodney F Benjamin and Cummins, 2001, "Modern Experimental Biochemistry", 2nd edition, Pearson Education, UK.

## References

- 1 Freifelder D, 1982, "Physical Biochemistry: Application to Biochemistry and Molecular Biology", 2nd edition, W. H. Freeman Publishers, USA
- 2 Walker J & Wilson K, 2000, "Principle & Technique - Practical Biochemistry", 5th edition, Cambridge university press, UK.
- 3 Rakesh S. Sengar , Amit Kumar , Reshu Chaudhary , Ashu Singh,  
2018, "Advances in Molecular Techniques", 1st edition, CRC Press, USA.
- 4 Walt Ream, Katharine GF, 1998, "Molecular Biology Techniques: An Intensive Laboratory", Academic Press, USA.

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193BT 1A4GA	GENERIC ELECTIVE -II: APICULTURE	SEMESTER IV
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Total Credits: 2

Total Instruction Hours: 24 h

### Syllabus

**Unit I** History 5 h

History of Bee keeping – Present status of Apiculture in India – species of honey bees.

**Unit II** Lifecycle and Cultivation 5 h

Bee colony, Castes. Natural colonies and their yield. Types of beehives – structure – location, care and management.

**Unit III** Apiculture Industry 5 h

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

**Unit IV** Social status of Apiculture 5 h

Bee foraging: Pollen and nectar yielding plants. Honey Extraction, seasonal maintenance. Economics of Apiculture and Management.

**Unit V** National and International Status 4 h

Honey yield in national and international market. Prospects of apiculture as self-employment venture.






## Text Books

- 1 Ghosh G K, 1998, "Beekeeping in India" , Ashish Publishers, India.
- 2 Abrol D P, 2010, "A Compressive Guide to Bees and Beekeeping", Scientific Publishers, India.

## References

- 1 Singh D & Singh DP, 2006, "A Handbook of Beekeeping", Agrobios, India.
- 2 NPCS Board of Consultants & Engineers, 2015, "The Complete Book on Beekeeping and Honey Processing", 2nd edition, NIIR Project Consultancy Services, India.
- 3 Davis I & Cullum-kenyan R, 2019, "Guide to Beekeeping", 2nd edition, Bloomsbury Publication, Australia.
- 4 Rahman A, 2018, "Text Book on Beekeeping", 1st edition, Kalyani Publications, India.

		
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191TL1A4AA	பகுதி - 4 : அடிப்படைத்தமிழ் - தாள் : II (Basic Tamil )	SEMESTER IV
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Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019-20ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது  
(10 மற்றும் 12 - ஆம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயிலாதவர்களுக்கு)  
(பருவத் தேர்வு உண்டு )

அலகு : 1

12 h

நீதி நூல்கள்

I.ஆத்திசூடி - “அறம் செய விரும்பு” முதல் “ஒளவியம் பேசேல்”வரை -12 பாடல்கள்

II.கொன்றைவேந்தன் - “அன்னையும் பிதாவும் முன்னறி தெய்வம்” முதல்

“எண்ணும் எழுத்தும் கண் எனத் தகும்” வரை -7 பாடல்கள்

III.திருக்குறள் - 6 பாடல்கள்

1. அகர முதல .....1
2. மனத்துக் கண்.....34
3. இனிய உளவாக .....100
4. தீயவை தீய பயத்தலான்.....202
5. கற்க கசடற .....391
6. கண்ணொடு கண்ணினை.....1100

அலகு : 2

12 h

I. எளிய நீதிக்கதைகளும் வாழ்க்கை முறைகளும்

1. நீதிகாத்த மன்னன்
2. சிங்கமும் முயலும்
3. புத்திசாலி உழவனும் போக்கிரிப் பூதமும்
4. தேனீயும் புறாவும்
5. முயல் கூறிய தீர்ப்பு

II. தமிழகப் பண்பாடுகள்

1. தமிழர் விழாக்கள் - பொங்கல், ஆடிப்பெருக்கு
2. தமிழர் கலைகள் - தெருக்கூத்து, ஓவியம், சிற்பம்
3. தமிழர் விளையாட்டுகள்- ஏறுதழுவுதல், சடுகுடு



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### III . பயிற்சிப் பகுதி

1. படத்திற்கு ஏற்ற சொற்களை எழுதுதல்.
2. சொற்களைத் தொடராக்குதல்.
3. பொருத்துதல்,
4. உரையாடல் பகுதி

**Note:** பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

வினாத்தாள் அமைப்பு முறை - மொத்த மதிப்பெண்கள் - 100

பகுதி - அ

சரியான விடையைத் தேர்வு செய்தல் 10x2=20

பகுதி - ஆ

சரியா? தவறா? தேர்ந்தெடுத்து எழுதுக . 10x2=20

பகுதி - இ

ஒரு பக்க அளவில் விடையளிக்க 03x20=60

குறிப்பு:


- அனைத்து அலகுகளில் இருந்தும் வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ -க்கான வினாக்கள் இது அல்லது அது என்ற அடிப்படையில் அந்தந்த அலகுகளில் அமைதல் வேண்டும்

### Text Books

- 1 அடிப்படைத்தமிழ் - 20-21. தொகுப்பு : தமிழ்த்துறை , டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி)லிட். சென்னை-600 098

### References

- 1 ஒன்றாம் வகுப்பு பாடநூல் - தமிழ்நாடு அரசு பாடநூல் கழகம்
- 2 வலைதள முகவரி : <http://tamilvu.org>

		
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191TL1A4AB	பகுதி - 4 : சிறப்புத்தமிழ் - தாள் : II (Advanced Tamil )	SEMESTER - IV
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Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019- 2020 ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது  
(10 மற்றும் 12 - ஆம் வகுப்புகளில் தமிழ் மொழிப்பாடம் பயின்றவர்களுக்கு உரியது  
(பருவத் தேர்வு உண்டு )

அலகு - 1 05 h

திருக்குறள்

I அறத்துப்பால்

1. இனியவை கூறல் - அதிகார எண் : 10
2. அடக்கமுடைமை - அதிகார எண் : 13

II பொருட்பால்

1. கல்வி - அதிகார எண் : 40
2. உழவு - அதிகார எண் : 104

III இன்பத்துப்பால்

1. தகையணங்குறுத்தல் - அதிகார எண் : 109
2. பிரிவாற்றாமை - அதிகார எண் : 116

அலகு - 2 05 h

கட்டுரைத் தொகுப்பு

I நல்வாழ்வு - டாக்டர் மு.வரதராசன்

1. நம்பிக்கை
2. புலனடக்கம்
3. பண்பாடு

II இளைஞர்களின் ஒளிமயமான எதிர்காலத்திற்கு - கு.வெ. பாலசுப்பிரமணியம்

1. காலக்கணக்கு
2. நற்பழக்கமே செல்வம்

அலகு - 3 05 h

I காப்பியங்கள் - குறிப்பு எழுதுதல்

1. சிலப்பதிகாரம்
2. மணிமேகலை
3. கம்பராமாயணம்
4. பெரியபுராணம்



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II ஊடகம் - காட்சி ஊடகங்கள்

1. தொலைக்காட்சி
2. திரைப்படம்
3. இணையம்
4. முகநூல்
5. கீச்சகம்
6. கட்செவி அஞ்சல்

அலகு - 4

05 h

இலக்கணம் - வழக்கறிதல்

1. இயல்பு வழக்கு
2. தகுதி வழக்கு

அலகு - 5

04 h

I படைப்பாற்றல் பகுதி

கவிதை,கட்டுரை எழுதச்செய்தல் - பொதுத் தலைப்பு

II பயிற்சிப் பகுதி

தமிழில் தட்டச்சு செய்தல் - யூனிகோடு எழுத்துருவில்.

**Note:** பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

வினாத்தாள் அமைப்பு முறை - மொத்த மதிப்பெண்கள் - 100

பகுதி -அ

சரியான விடையைத் தேர்வு செய்தல்

10x2=20

பகுதி -ஆ

கோடிட்ட இடங்களை நிரப்புக

10x2=20

பகுதி -இ

இரண்டு பக்க அளவில் விடையளிக்க

4x15=60

குறிப்பு :

- அனைத்து அலகுகளில் இருந்தும் இரண்டு வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ -க்கான வினாக்கள் இது அல்லது அது என்ற வகையில் அந்தந்த அலகுகளிலிருந்து அமைதல் வேண்டும்.



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### Text Books

- 1 சிறப்புத்தமிழ் 20-21. தொகுப்பு : தமிழ்த் துறை , டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி) லிட். சென்னை- 600 098

### References

- 1 பேராசிரியர் புலவர் சோம . இளவரசு, எட்டாம் பதிப்பு - 2014, தமிழ் இலக்கிய வரலாறு - மணிவாசகர் பதிப்பகம், சென்னை - 600 108.
- 2 பேராசிரியர் முனைவர் பாக்கியமேரி , முதற் பதிப்பு - 2013, இலக்கணம் - இலக்கிய வரலாறு - மொழித்திறன் -பூவேந்தன் பதிப்பகம், சென்னை-600 004.
- 3 வலைதள முகவரி : <http://tamilvu.org>

		
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192PY1A4AA	AECC : GENERAL AWARENESS	SEMESTER IV
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Total Credits: 2  
Total Instructions Hours: 24 h

S.No	Contents
1	Current Events
2	General Science
3	Geography of India
4	Tamil and Other Literature
5	Inventions and Discoveries
6	Numerical and Mental Aptitude
7	Verbal and Non Verbal Reasoning
8	Socio- Culture and Heritage of India
9	Indian Economy and Political System
10	History of India and Freedom Struggle

### References

- 1 Majid Hussain, Arrora N D, 2019, "General Studies -TNPSC Group -I ", G.K.Publications (P) Ltd. New Delhi
- 2 Aggarwal R S, 2014, "Verbal and Non Verbal Reasoning" S Chand & Company, New Delhi
- 3 Competition Success Review, Competitive Success Publisher, New Delhi
- 4 Pratiyogita Darpan, Pratiyogita Darpan Publishers, Agra.

		
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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fifth Semester										
Part - III										
193BT1A5CA	Core - IX	Recombinant DNA Technology	4	1	-	3	25	75	100	4
193BT1A5CB	Core - X	Plant and Animal Biotechnology	4	1	-	3	25	75	100	4
193BT1A5CC	Core - XI	Bioprocess Technology	4	1	-	3	25	75	100	3
193BT1A5CP	Core Practical	rDNA, Bioprocess, Plant & Animal Biotechnology	-	-	5	6	40	60	100	2
193BT1A5SA	SEC - III	Entrepreneurial Biotechnology	3	1	-	3	25	75	100	3
193BT1A5DA	DSE - I	Clinical Trials	3	1	-	3	25	75	100	4
193BT1A5DB		Biomaterials								
193BT1A5DC		Food Biotechnology								
193BT1A5LA	LoP	Lab on Project	-	-	-	-	50	-	50	1
193BT1A5TA	IT	Industrial Training	Grade A to C							
Part - IV										
192MT1A5AA	AECC - V	Research Methodology	2	-	-	2	-	50	50	2
Total			20	5	5				700	23





Course Code	Course Name	Category	L	T	P	Credit
193BT1A5CA	RECOMBINANT DNA TECHNOLOGY	CORE	4	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals of recombinant DNA technology
- The different types of vectors used in recombinant DNA technology
- The application of recombinant DNA technology

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the steps in recombinant DNA preparation, introduction and selection	K1,K2
CO2	Explain the features of various types of bacterial cloning vectors	K1, K2
CO3	Explain the features of various types of cloning vectors for yeast, animal and plants	K1,K2
CO4	Describe and apply various molecular techniques	K2, K3
CO5	Demonstrate the different applications of recombinant based products	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	M	S	M	M	M
CO3	S	S	M	M	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S                      Strong                      M                      Medium                      L                      Low



193BT1A5CA	RECOMBINANT DNA TECHNOLOGY	SEMESTER V
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Total Credits: 4

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Fundamentals of recombinant DNA technology 12 h

History and scope of rDNA technology, Strategies of cloning, Cutting and Joining of DNA- Linkers and Adapters, other enzymes involved in cloning, Features of host cell. Selectable and Screenable markers used in recombinant DNA technology.

#### Unit II Cloning vectors for Bacteria 12 h

Plasmids - properties of plasmid, types of plasmids, plasmid compatibility and incompatibility, copy number and its control. Features of Bacterial Vectors, E. coli vectors- pBR322 and pUC vectors, Bacterial Artificial Chromosome (BAC). Cloning in Bacillus.

#### Unit III Viral vectors and other special vectors 12 h

Viral Vectors Lambda Phage vectors, cosmid, phagemid, M13. Yeast vectors- YIP, YEP, YRP and YAC. Animal vectors- SV40 Vectors, Retero viral and Baculo viral vectors. Plant Vectors- Ti plasmid as a gene vector, expression vectors and shuttle vectors.

#### Unit IV Molecular techniques and their applications 12 h

Construction of cDNA and genomic DNA libraries. PCR and its types. DNA Sequencing, Probes - probe construction and labeling. Introduction of cloned genes into cell- transformation, particle bombardment, liposome mediation, and electroporation. Blotting techniques Southern, Western and blotting. Micro array.

#### Unit V Applications of Recombinant DNA based products 12 h

Recombinant DNA based products - Humulin, Somatotropin, Erythropoietin, Tissue Plasminogen activator, Factor-VIII and Interferon. Ethical issues in GM products, Institutional Animal Ethics Committee, Recombinant DNA Advisory Committee and Institutional Bio safety Committee.






### Text Books

- 1 Brown, T. A, 1998, "Introduction to Gene Cloning", 3rd Edition, Stanley Thornes Publishing Ltd.
- 2 Primrose, S. B, 2003, "Principles of Gene Manipulation", 6th Edition, Blackwell Science Ltd.

### References

- 1 Ernst. L. Winnacker, 2003, "From Genes to Clones", 2nd Edition, Panima Publishing Corporation.
- 2 James. D. Watson, 2001, "Recombinant DNA technology", 2nd Edition, WH Freeman and company.
- 3 Brown, T.A, 2016, "Gene Cloning and DNA Analysis", 7th Edition, Wiley Blackwell.
- 4 Primrose, S.B. and Twyman, R. 2013, "Principles of Gene Manipulation and Genomics", 7th Edition, Wiley Blackwell.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A5CB	PLANT AND ANIMAL BIOTECHNOLOGY	CORE	4	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals of Plant tissue culture and its application in laboratory settings
- Plant genetic engineering techniques and its applications
- Production of animal cells in culture and its maintenance

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Impart knowledge on basics of plant tissue culture and its requirements	K1
CO2	Acquire knowledge about the gene transfer techniques and applications	K2
CO3	Understand the genetic engineering and gene modification in agriculture	K3
CO4	Gain insight on animal cell culture methods	K2, K3
CO5	Highlight the maintenance of animal cells in culture	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	M	S
CO5	S	S	S	S	S

S

Strong

M

Medium

L

Low



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193BT1A5CB	PLANT AND ANIMAL BIOTECHNOLOGY	SEMESTER V
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Total Credits: 4

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Plant tissue culture 12 h

Tissues culture media - Composition and its preparation. Plant Tissue Culture applications- Micropropagation, Callus culture, somatic embryogenesis, suspension culture, embryo culture, haploid culture, protoplast culture and fusion, Somoclonal variation, artificial seeds, hardening.

#### Unit II Gene transfer 12 h

Plant transformation technology- Ti and Ri plasmids, binary & co-integrated vector systems; viral vectors and their applications; 35S and other promoters; genetic markers-reporter genes- Cloning Strategies- Gene transfer methods in plants- Direct DNA transfer methods, Agrobacterium mediated nuclear transformation.

#### Unit III Plant Genetic Engineering 12 h

Applications of Plant Genetic Engineering - crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Genetic modification in Agriculture - transgenic plants, genetically modified foods, ecological impact of transgenic plants.

#### Unit IV Animal cell culture 12 h

Culture media; Balanced salt solutions and simple growth medium, Physical, chemical and metabolic functions of different constituents of culture medium; Role of carbon dioxide, serum, growth factors, glutamine in cell culture; Serum and protein free defined media and their applications. Risks in a tissue culture laboratory and safety - biohazards. Facilities for animal cell culture- infrastructure, equipment, culture vessels.

#### Unit V Animal Cell, Tissue and Organ culture 12 h

Primary cell culture techniques - mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture of cells - manipulation of cell line selection - types of cell lines -maintenance of cell lines - immobilization of cells and its application - synchronization of cell cultures. Cryopreservation - germplasm conservation. Medical/pharmaceutical products of animal cell culture.



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### Text Books

- 1 Singh, B. D, 2006, "Plant Biotechnology", 1st Edition, Kalyani Publishers.
- 2 Ranga, M. M, 2000, "Animal Biotechnology", 1st Edition, Agrobios.

### References

- 1 Razdan, M. K, 2002, "Introduction to Plant tissue culture", 2nd Edition, Oxford & IBH publishing company.
- 2 Chawla, H. S, 2013, "Introduction to Plant Biotechnology", 3rd Edition, Oxford & IBH publishing company
- 3 Jennie P. Mathur and David Barnes, 1998, "Animal Cell Culture Methods", Volume 57, Academic Press.
- 4 Ian Freshney, R, 2015, "Culture of Animal Cells", 7th Edition, Wiley Blackwell.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A5CC	BIOPROCESS TECHNOLOGY	CORE	4	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The basics of bioprocess technology and its industrial applications.
- The industrial based bioprocess production.
- The upstream, downstream processes of microbial products.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts of industrial important strain isolation, preservation and strain improvement.	K2
CO2	Acquire knowledge on industrial level media preparation and sterilization process.	K3
CO3	Learn about industrial bioreactors types and monitoring control.	K3
CO4	Gather knowledge on the recovery and purification of fermentation products using various analytical methods	K3, K4
CO5	Articulate the knowledge of microbial products in commercial based applications.	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	M	M
CO5	M	S	M	M	S

S

Strong

M

Medium

L

Low



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193BT1A5CC	BIOPROCESS TECHNOLOGY	SEMESTER V
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Total Credits: 3

Total Instruction Hours: 60 h

### Syllabus

#### Unit I Introduction to Bioprocess Technology 12 h

Introduction to Bioprocess Technology: components and types of fermentation process, industrially important microorganisms: isolation, screening, preservation and maintenance. Strain improvement: mutation, protoplast fusion, rDNA technology, genomics, transcriptomics, fluxomics and engineered microbes.

#### Unit II Industrial Media Preparation and Sterilization 12 h

Medium requirements for bioprocess technology, carbon, nitrogen, mineral sources, buffers, antifoam agents and medium optimization. Sterilization of media and fermenters, scale – up process and starter culture technology. Rheological properties of media.

#### Unit III Types of Bioreactor 12 h

Introduction: Bioreactor and Fermenter, Basic design of a microbial reactor, Classification of Bioreactor and Industrial applications: Stirred Tank Reactor, Airlift Reactor, Bubble Column Reactor, Packed Bed Reactors, Fluidized Bed Reactor, Photobioreactor and Membrane Bioreactor. Monitoring and control of bioreactor process.

#### Unit IV Downstream Processing 12 h

Recovery and Purification of fermentation products: Removal of microbial cells and other solid materials, foam separation, Precipitation, Filtration and Centrifugation. Cell Disruption- Physical, Chemical methods, extractors, chromatography, membrane process, drying, crystallization and whole broth processing.

#### Unit V Applications of Bioprocess Technology 12 h

Bioprocess Economics: National and International Market potential of microbial products and future trends. Exploration of commercially important microbial products and applications: Therapeutic drugs (Monoclonal antibodies and insulin), Biofuel Production (Bioethanol and Methane), Antibiotics (Penicillin and Streptomycin), Amino acids (Glutamic acid and Aspartic acid) and Organic acids (Lactic acid and citric acid), Probiotics and Single Cell Proteins (SCP).






### Text Books

- 1 Kalaichelvan, P.T. Arulpandi, I, 2007, "Bioprocess Technology", 1st Edition, MPJ Publishers.
- 2 Peter F Stanbury, Allan Whitaker, Stephen J Hall, 2017, "Principles of Fermentation Technology", 3rd Edition, Butterworth-Heinemann (Elsevier).

### References

- 1 Arindam Kuila and Vinay Sharma, 2018, "Principles and Applications of Fermentation Technology", 1st Edition, Scrivener Publishing.
- 2 Hrudayanath Thatoi , Pradeep K. Das Mohapatra, Sonali Mohapatra, Keshab C. Mondal, 2020, "Microbial Fermentation and Enzyme Technology", 1st Edition, CRC Press.
- 3 Michael L. Shuler and Fikret Kargi, 2015, "Bioprocess Engineering: Basic Concepts", 2nd Edition, Pearson Education India.
- 4 Pauline M. Doran, 2012, "Bioprocess Engineering Principles", 2nd Edition, Elsevier

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193BT1A5CP	rDNA, Bioprocess, Plant & Animal Biotechnology	SEMESTER V
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Total Credits: 2

Total Instructions Hours: 60 h


S.No	Contents
1	Isolation of Genomic DNA from bacteria
2	Isolation of Plasmid DNA from bacteria
3	Isolation of Genomic DNA from Plant Tissue
4	Isolation of Genomic DNA from Animal Tissue
5	Southern blotting & Western Blotting
6	PCR*
7	Restriction Digestion and Ligation*
8	Screening of Antibiotic producing & Amylase producing microorganism
9	In vitro germination of seeds
10	Micro propagation & Callus induction
11	Artificial seed production
12	Isolation of Chick Embryo fibroblast
13	Isolation of liver and spleen cells (Chicken)
14	Animal Cell count
15	Cell viability test

**Note:** \*DBT STAR college experiments





- 1 Satish Kumar Sinha. 2012. Plant tissue culture: Theory and Practice. 1st edition. Oxford University Press
- 2 Choudhary, S. S, Choudhary, P. and Choudhary, S.K. 2005. Laboratory guide in biosciences. 2nd edition. Kalyani publishers.
- 3 Razdan, M. K. 2002. Introduction to Plant tissue culture. 2nd edition. Oxford & IBH publishing company.
- 4 R. Ian Freshney. 2010. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, Sixth Edition. John Wiley & Sons, Inc

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A5SA	ENTREPRENEURIAL BIOTECHNOLOGY	SEC	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- Entrepreneurial opportunities in Biotechnology
- Good laboratory procedure and practices and standard operating
- IPR and safety issue of the biological products

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of Entrepreneurship strategy	K1,K2
CO2	Know the business opportunities in plant tissue culture companies	K1,K2
CO3	Understand the farming technique and certification procedures	K1,K2
CO4	Learn about business scope in commercial important products like Biofertilizer, Biopesticide, Vermicompost etc	K1,K2
CO5	Apply the Biopharmaceutical products, IPR and product safety management in industry	K2,K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S



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**Strong**

**M**

**Medium**

**L**

**Low**

*B.Sc. Biotechnology (Students admitted during the AY 2021-22)*



193BT1A5SA	ENTREPRENEURIAL BIOTECHNOLOGY	SEMESTER V
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**Total Credits: 3**

**Total Instruction Hours: 48 h**

### Syllabus

**Unit I Introduction 10 h**

Concept of Entrepreneurship, Definition, characteristics of entrepreneurship, Types of entrepreneurship. Startup process. Business identification, Project plan, Source of fund, production and marketing. Importance of ROC, Risk involved in entrepreneurship.

**Unit II Opportunities in PTC 9 h**

Business opportunities in Plant Tissue Culture – Banana, Bamboo, Sugarcane and Orchids like Carnation and Gerbera. Important PTC companies in India.

**Unit III Procedures and Certification in Organic farming 9 h**

Organic farming- Methods, Standards, Market potential and products impact. Tamilnadu Organic Certification Department (TNOCD) – process of organic certification, TNOCD certified products.

**Unit IV Commercialization 10 h**

Business scope for Biofertilizer, Biopesticide, Vermicompost, Mushroom, Single Cell Protein, Apiculture, Dairy products (Example with one commercially important product for all the above)

**Unit V Biopharmaceutical products, IPR and product safety 10 h**

Insulin, Vaccines, Therapeutic products, Monoclonal antibodies, Hormones, Interferon (Example with one commercially important product for all the above). Importance of IPR, Patents, Trade Marks, Trade secret, Copyright, Product safety and liability, Insurance and contracts.

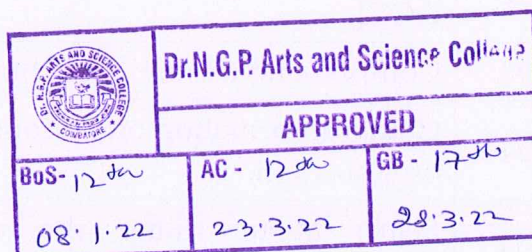


### Text Books

- 1 Kumari Manimuthu Veeral, D, 2015, "Textbook of organic farming", Agrotech Publishing Academy.
- 2 Kanka, S. S., 1997, "Entrepreneurship Development", S. Chand and Co.

### References

- 1 Kolehinsky P, 2004, "The Entrepreneur's guide to Biotechnology startup", 4th Edition, www.elelexa.com
- 2 Casson M, Yeung B, Basu A and Wadespm N, 2006, "The Oxford Handbook of Entrepreneurship", Oxford University Press.
- 3 Shimasaki C, 2014, "Biotechnology Entrepreneurship", 1st Edition, Academia Press.
- 4 Eric Ries, 2011, "The Lean Startup", 1st Edition, Kindle Publication.





Course Code	Course Name	Category	L	T	P	Credit
193BT1A5DA	CLINICAL TRIALS	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The regulations on clinical trials.
- The different guidelines applicable.
- The difference between different phases of clinical trials.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the phases of pre-clinical trials	K2
CO2	Gain knowledge on clinical guidelines and regulations of DCGI	K3
CO3	Comprehend the ethics of clinical trials	K3
CO4	Gather information on various guidelines of international organization.	K3, K4
CO5	Learn about filling the consent forms and data information sheets.	K3, K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	S

S Strong

M Medium

L Low



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193BT1A5DA	CLINICAL TRIALS	SEMESTER V
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Pharmaceutical Industry 10 h

Introduction to Pharmaceutical Industry, Preclinical studies - Preclinical technology. Phase I, Phase II A and B, Phase III A and B, Phase IV and Types of Post marketing surveillances.

#### Unit II DCGI and FDA Regulations 10 h

DCGI - roles and responsibilities - Clinical research regulation of DCGI. FDA Regulations for Clinical Trials, FDA Guidelines and Information Sheets, FDA Compliance Program Guidance Manuals, FDA Bioresearch Monitoring Program (BIMO).

#### Unit III Ethical Guidelines 10 h

Ethical Guidelines for Biomedical Research in Human Subjects, Central Ethics committee on Human Research (CECHR), Ethics in Clinical Research for Communicable and Non Communicable Diseases. Ethics concerned with virology and serology studies.

#### Unit IV Guidelines of Various Organizations 10 h

History of GCP, ICH Guidelines for Good Clinical Practice, Central Drugs Standardization and Control Organization, Government of India, Schedule Y.

#### Unit V Consent and Ethics 8 h

CRF design, Informed Consent Documents - Subject Information Sheet and Informed Consent Form, Ethics Committee Approvals.






## Text Books

- 1 Katzung, B.G, 1995, "Basic and Clinical Pharmacology", 12th Edition, Prentice Hall of Intl.
- 2 Muruges, N, 2014, "A Concise text book of Pharmacology", 7th Edition, Sathya Publications.

## References

- 1 Hackshaw, A, 2009, "A Concise Guide to Clinical Trials", 1st Edition, Wiley Publishers.
- 2 Chin, R, and Bruce Y.L, 2008, "Principles and Practice of Clinical Trial Medicine", 1st Edition, Academic Press.
- 3 Weinberg, S, 2009, "Guide Book for Drug Regulatory Submissions", 1st Edition, John Wiley & sons.
- 4 Haynes, R.B., Sackett, D.L., Guyatt, G.H., and Tugwell, P, 2005, "Clinical Epidemiology: How to Do Clinical Practice Research", 3rd Edition, Lippincott- Williams and Wilkins.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A5DB	BIOMATERIALS	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The basic concepts of Biomaterials
- The naturally occurring Biomaterials
- About the different types of biomaterials and its application medical field

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Biomaterials and its applications	K2
CO2	Biomaterials extracted from Protein.	K3
CO3	Biomaterials extracted from Carbohydrates.	K3
CO4	Biopolymers, synthesis and its uses	K3, K4
CO5	Biocompatibility materials used in medical field	K3, K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S

Strong

M

Medium

L

Low



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193BT1A5DB	BIOMATERIALS	SEMESTER V
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

**Unit I** Fundamentals of Biomaterials 10 h

Biomaterials- properties of biomaterials, Surface Properties and Surface Characterization of Biomaterials, Role of Water in Biomaterials. Applications of biomaterials in medical field.

**Unit II** Protein as Biomaterials 10 h

Collage and Gelatin-Alginate: Structure, Preparation and application. Fibroin (protein in silk): Production and its use.

**Unit III** Carbohydrates as Biomaterials 10 h

Carbohydrates: Modified carbohydrates; Actin gas lubricants for biomedical applications; Bacterial Polydextrose; Carbohydrates modified from enzymes, Cellulose and Chitin-Chitosan: structure, preparation and application

**Unit IV** Biopolymers 10 h

Biopolymers: Synthesis from a simple biological monomer - hyaluronate polymer; Dextran, Rubber produced by bacteria and fungi, PHB, PCL; Production of a copolymer of PHB and PHV.

**Unit V** Biocompatibility materials 8 h

Metallic Implant materials, Ceramic implant materials, Polymeric implant materials, Skin and Maxillofacial implant and blood interfacing implants.




## Text Books

- 1 Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, M.D, Jack E. Lemons, 2013, "Biomaterials Science An Introduction to Materials in Medicine", 3rd Edition, Elsevier Inc.
- 2 Ratledge, C. and Kristiansen, B., 2001, "Basic Biotechnology", 2nd Edition, Cambridge University Press.

## References

- 1 Yoshiharu D, 1990, "Microbial polyesters", 1st Edition, VCH Weinheim Publishers.
- 2 Joon Park and Lakes R. S, 2007, "Biomaterials: An Introduction", 3rd Edition, Springer Verlag Publishers.
- 3 David Byrom, 1991, "Novel materials from biological source", 1st Edition, Macmillan Publishers Limited.
- 4 Masoud Mozafari, 2020, "Handbook of Biomaterials and Biocompatibility", 1st Edition, Woodhead Publishing.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A5DC	FOOD BIOTECHNOLOGY	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The role of microbes in food industry.
- The food preservation techniques in food industry.
- The food safety and quality control system.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of food technology	K2
CO2	Gain information on role of microbes in foods	K3
CO3	Comprehend the food preservation techniques	K3
CO4	Correlate the food packaging techniques in food industries	K3, K4
CO5	Articulate food safety techniques in food industries	K3, K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	M	S

S Strong

M Medium

L Low



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193BT1A5DC	FOOD BIOTECHNOLOGY	SEMESTER V
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**Total Credits: 4**

**Total Instruction Hours: 48 h**

### Syllabus

#### **Unit I** Introduction to food technology 10 h

Role of biotechnology in food production - transgenic plant foods: carbohydrates, proteins, vitamins nutritional quality improvement of the food crops by genetic engineering. Production of food from fungi, algae and bacteria: SCP, mushrooms production technology.

#### **Unit II** Role of Microbes in food production 10 h

Homo & hetero-fermentative bacteria, yeasts & fungi; Lactic acid bacteria fermentation and starter cultures, Alcoholic fermentations -Yeast fermentations - fungal fermentations. Microbes associated in yoghurt, cheese, fermented milks, breads, idly and soya products.

#### **Unit III** Traditional Foods & Techniques of food preservation 10 h

Traditional south Indian foods history – rice based, pickles, curry podi, jaggary sweets. Role of banana leaf packing and serving. Canning, cold storage, freezing, cryogenic freezing. Preservation by fermentation: curing and pickling. Use of preservative: chemical preservative, class II preservatives, bio-preservatives.

#### **Unit IV** Food Packaging 10 h

Definition, factors involved in selection, functions of food packaging. Types of packaging materials and their functioning properties; Aseptic packaging of foods:sterilization techniques of food and packaging material; Advantages and disadvantages associated with packaging of foods.

#### **Unit V** Food safety and quality control 8 h

Impact of food safety on global trade; Food safety in retail food businesses; international food service operators, institutional food service operators. HACCP, Surveillance networks, functions of USFDA, USDA and EPA; Food Safety and Standards Act India 2006; Prevention of Food Adulteration Act, India, 1954.






## Text Books

- 1 Byong, H.L, 2004, "Fundamentals of Food Biotechnology", 2nd Edition, Wiley Blackwell.
- 2 Perry, J.G, 2002, "Introduction to Food Biotechnology", 1st Edition, CRC Press.

## References

- 1 Gustavo F. Gutierrez-Lopez, Gustavo V. Barbosa Canosa, 2003, "Food Science and Food Biotechnology", 1st Edition, CRC Press.
- 2 Shivashraya Singh, 2014, "Dairy Technology", 2nd Edition, New India Publishing Agency.
- 3 McSwane D, 1997, "Essentials of Food Safety and Sanitation", 2nd Edition, Prentice Hall.
- 4 Motarjemi, Y. and Lelieveld, H, 2013, "Food Safety Management", 1st Edition, Academic Press.

		
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BoS- 12 <sup>th</sup>	AC - 12 <sup>th</sup>	GB - 17 <sup>th</sup>
08.1.22	23.3.22	28.3.22



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*B.Sc. Biotechnology (Students admitted during the AY 2021-22)*

Course Code	Course Name	Category	L	T	P	Credit
192MT1A5AA	RESEARCH METHODOLOGY	AECC	2	-	-	2

### PREAMBLE

This course has been designed for students to learn and understand

- the art of using different research methods and techniques
- planning and writing of research proposals and dissertations, as well as a thesis
- the necessity for research ethics and guidelines to pursue research

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	learn the basics of the research methods and techniques	K1
CO2	remember the hypothesis, laws related to research problem	K1
CO3	understand the limitations of experimentation in research	K2
CO4	illustrate the concept of interdisciplinary and multidisciplinary research	K3
CO5	analyze the ethics and responsibilities of research	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

**S Strong**

**M Medium**

**L Low**



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*B.Sc. Biotechnology (Students admitted during the AY 2021-22)*



192MT1A5AA	RESEARCH METHODOLOGY	SEMESTER V
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Total Credits: 2

Total Instruction Hours: 24 h

### Syllabus

**Unit I** Introduction to Research 4 h

Research: Introduction- Basic, Applied and Evaluation research – multidisciplinary and interdisciplinary Research – value of research skills – formulating a research problem – Research in relation to Teaching and Publishing

**Unit II** Hypotheses, Theories and Laws 6 h

Hypotheses – Theories – Laws. Scientific statements: their justification and acceptance: verification – Falsification – Acceptance – Peer review

**Unit III** Experimentation and research 5 h

The roles and limitations of experimentation – Experimentation and research – conducting experiments – validity and reliability in experimentation – Design of experiments

**Unit IV** Scientific method and Research Design 4 h

Introduction to Scientific method – Research Design – Components – research design and proposal – checklist in the preparation of proposals

**Unit V** Ethics and Responsibility in Scientific Research 5 h

Ethics – guidelines for Ethical practices in research – unethics to ethics in research – responsibility of Scientists and of Science as an Institution




## Text Books

- 1 PerterPruzan, (2016), Research Methodology: The Aims, Practices and Ethics of Science. Springer, Switzerland

## References

- 1 Thomas, C.G. (2015) Research Methodology and Scientific Writing. Ane Books Pvt. Ltd.: New Delhi.
- 2 Locharoenrat, K. (2017) Research Methodologies for Beginners. Pan Stanford Publishing: Singapore.
- 3 Ranjit Kumar, (2014) Research Methodology: A Step-by-Step Guide for Beginners. SAGE Publications Ltd.: Singapore.
- 4 Kothari, C.R. Garg, G. (2009) Research Methodology Methods and Techniques. New Age International Publishers, New Delhi..

		
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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Sixth Semester										
Part-III										
193BT1A6CA	Core -XII	Bioprospecting	3	1	-	3	25	75	100	4
193BT1A6CB	Core -XIII	Environmental Biotechnology	3	1	-	3	25	75	100	4
193BT1A6CC	Core - XIV	Bionanotechnology	3	1	-	3	25	75	100	3
193BT1A6CP	Core Practical	Bioprospecting, Environmental Biotechnology & Bionanotechnology	-	-	5	6	40	60	100	2
193BT1A6SA	SEC - IV	Pharmaceutical Biotechnology	3	-	-	3	25	75	100	3
193BT1A6DA	DSE-II	Genomics	3	1	-	3	25	75	100	4
193BT1A6DB		Bioethics & Biosafety								
193BT1A6DC		Drug Design & Delivery								
193BT1A6DD	DSE-III	Proteomics	3	1	-	3	25	75	100	4
193BT1A6DE		Biomarker Technology								
193BT1A6DF		Stem Cell Technology								
Part - IV										
193BC1A6AA	AECC - VI	Innovation, IPR and Entrepreneurship	2	-	-	-	-	-	50	2
Part-V										
193BT1A6XA		Extension Activity	-	-	-	-	50	-	50	1
Total			20	5	5				800	27
Grand Total									4400	140



Course Code	Course Name	Category	L	T	P	Credit
193BT1A6CA	CORE - XII : BIOPROSPECTING	CORE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The introduction about Bioprospecting and Biodiversity
- The Bioprospecting potentials of available natural resources
- The regulations related with biodiversity and bioprospecting

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Familiarize the students in major areas of bioprospecting and biodiversity	K2
CO2	Apprehend the bioprospecting aspects related to microorganisms	K2,K3
CO3	Obtain a comprehensive knowledge about natural products from plants	K2,K3
CO4	Gain the knowledge about bioprospecting knowledge about marine sources	K2,K3
CO5	Familiar with regulatory legislation and convention in bioprospecting for commercialization	K3,K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S



**Strong**

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**M**

**Medium**

**L**

**Low**

*B.Sc. Biotechnology (Students admitted during the AY 2021-22)*



193BT1A6CA	CORE - XII : BIOPROSPECTING	SEMESTER VI
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**Total Credits: 4**

**Total Instruction Hours: 48 h**

### Syllabus

#### **Unit I**      Bioprospecting and Biodiversity 09 h

Biodiversity in different agro ecological regions, endangered species, inventorisation and monitoring. Introduction, concepts and practices of bioprospecting; Traditional and modern bioprospecting; bioprospecting and biodiversity.

#### **Unit II**      Bioactive Compounds from Microbes 10 h

Aerobic and anaerobic (extremophiles/archaea) organisms for bioprospecting. Bioactive compounds from microbes: bacteria, actinomycetes and fungi for antibiotics, antiviral compounds and anticancer agents. Plant growth promoting bacteria - *Azospirillum lipoferum*, *Bacillus licheniformis*, *Pseudomonas chlororaphis*, *Rhizobia* sp.

#### **Unit III**      Bioactive Compounds from Plants 10 h

Bioprospecting of plants for novel medicines, random, ethnobotanical approaches and indigenous traditional knowledge for screening of medicinal plants. Isolation of crude and pure phytocompounds. Bioassays, structural elucidation, large scale production and market accessibility of phytocompounds.

#### **Unit IV**      Bioactive Compounds from Marine Sources 10 h

Discovery of novel compounds from marine sources: coral - terpenoids, diterpenoids; sponges - spongothymidine and spongouridine; bryozoans - secondary metabolites and anti cancer drugs; molluscs, tunicates and seaweeds.

#### **Unit V**      Metagenomics and regulations for Bioprospecting 09 h

Metagenomics: microbes from soil, plants, animals and human beings. Bioprospecting of novel genes/biomolecules and enzymes for industrial and medicinal uses. Regulations-Convention on Biological Diversity- Intellectual property rights- Patenting of new genes and/or bioactive principles.




## Text Books

- 1 Swaminathan, M.S. and Kocchar, S.L. (Es.) (1989). Plants and Society, MacMillan Publication Ltd.,
- 2 Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill Co., Ltd., New Delhi.

## References

- 1 Krishnan. S and Bhat. D.J. 2009. Plant and Fungal Biodiversity and Bioprospecting, Broadway Book Center, India.
- 2 Bull A. T. (ed.) 2004. Microbial Diversity and Bioprospecting, ASM Press, Washington DC.
- 3 Igor, P (ed.). 2011. Research in Biodiversity - Models and Applications, InTech publishers,
- 4 Russell Paterson, Nelson Lima. 2017. Bioprospecting: Success, Potential and Constraints. Springer, Cham.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A6CB	ENVIRONMENTAL BIOTECHNOLOGY	CORE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The ecosystem and organization
- The chemistry involved in environment
- The management of sustainable environment

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the structure and organization of ecosystem	K1, K2
CO2	Comprehend chemistry behind environmental effects	K3
CO3	Manage and control the pollution and wastage	K2, K3
CO4	Industrial Safety Management	K2
CO5	Comprehend the environmental policies	K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	M	M	S

S Strong

M Medium

L Low



193BT1A6CB	ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER VI
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**Total Credits: 4**

**Total Instruction Hours: 48 h**

### Syllabus

**Unit I** Ecosystem-structure and organization 09 h

Ecosystem-Definition, structure primary production, secondary production- food chain - food web- trophic levels- energy flow- pyramid of biomass-pyramid of energy. Biogeochemical cycle: Nitrogen and Phosphorous

**Unit II** Environmental chemistry 10 h

Chemistry of water, alkalinity and acidity of water, hardness of water, concept of BOD, and COD. Heavy metals, metal solubility, complexation and chelation. Surface and interface chemistry - Adsorption, absorption, catalysis, colloids, surfactants, examples, types of adsorption, desorption

**Unit III** Pollution and Waste Management 10 h

Pollution- types- sources- effects and its control measures- air- water-land-noise-thermal-pesticide-radioactive-greenhouse effect, ozone and its importance - global warming - Acid rain. Sewage Treatment System-Characteristics, Primary, secondary and tertiary treatment. Solid waste disposal and solid waste Management

**Unit IV** Industrial Safety Management 09 h

Industrial Safety Standards. Industrial Accidents and Disasters - Frequency Rate, Prevention and Control. Dispersion of Radioactive material and release of Toxic and inflammable materials. Work Study - Method of Study and Measurement. Measurement of Skills. Safety - Cost of Expenses. Principles and Functions in Safety Management

**Unit V** Environmental policies 10 h

International environmental policy - environmental problems and their impact on international system,- international law- soft law - (treaties, conventions and protocols).The Environmental Protection Act, 1986, The forest conservation act 1980, The Wildlife Protection Act 1972 (2002 amendment), Plastics Waste management Rules 2015



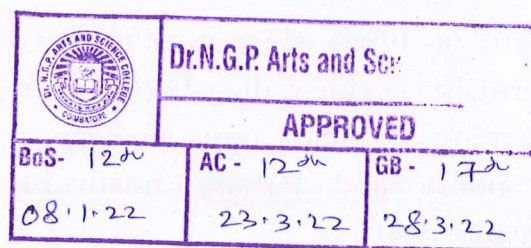


## Text Books

- 1 Singh, Y.K. 2006. Environmental Science. 1st Edition. New Age International (P) Limited, India
- 2 Agarwal, S.K. 2007. Environmental Biotechnology. 1st Edition. APH Publishing, India.

## References

- 1 Martin Alexander. 1999. Biodegradation and Bioremediation. 2nd edition. Academic Press, USA
- 2 Alan Scragg. 2007. Environmental Biotechnology. 2nd edition. Oxford university press
- 3 Miller, G.T., Scott, JR., Spoolman, E. 2010. Environmental Science. 13th Edition. Yolanda Cossio Publisher, USA
- 4 Mohapatra, P.K. 2006. Textbook of Environmental Biotechnology. 1st Edition. IK International Publishing House Pvt. Ltd., India



Course Code	Course Name	Category	L	T	P	Credit
193BT1A6CC	CORE:BIONANOTECHNOLOGY	CORE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The Basics of Bionanotechnology and its characteristics
- The latest trends of bionanoparticles in all fields
- The drug delivery system in nanotechnology

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn basic of Bionanotechnology	K1, K2
CO2	Understand the basic of Bionanomachinery and protein folding	K2
CO3	Elucidate the functional concept of biomaterials	K3
CO4	Learn about microarray technology, Nanobiosensors, Biochips and its application	K1, K2
CO5	Comprehend the drug delivery system and cancer biology based on bionanotechnology	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	M
CO5	S	S	M	M	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



193BT1A6CC	CORE:BIONANOTECHNOLOGY	SEMESTER VI
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Introduction to Nanotechnology 10 h

Opportunities and challenges of Nanotechnology. Key features of Nano-size, Comparison of particle behavior at nanosize to macrosize. Strategies for Nanoarchitecture (top down & bottom up approaches). Introduction to Nanobiotechnology – Biogenic nanoparticle synthesis from plants, bacteria and yeast. Biomolecular design

#### Unit II Structural Bionanotechnology 10 h

Structural principles of Bionanotechnology: Natural Bionanomachinery – (Eg lotus leaf effect, Gecko lizard, fish hair structures, butterfly wings). Overview of Nanodevices - Strategies for construction of Nanodevices using Carbon as a raw material. Protein folding Aspects: Stable structure, Globular proteins, Role of chaperones in folding, lipid bilayer, DNA based nanostructures

#### Unit III Functional Bionanotechnology 10 h

Principles of Functional Bionanotechnology. Information-driven nanoassembly: Energetics; Biomaterials- Filaments and fibrils, Minerals combined with biomaterials for specific applications. Biomolecular sensing taste and light sensors. Machine phase Bionanotechnology- Muscle sarcomeres and nerves

#### Unit IV Clinical based Bionanotechnology 09 h

Differentiation of Nanoparticles and Nanosystems. Conventional drug delivery & targeted drug delivery – its role and advantages; Clinical Trials involved in Bionanotechnology

#### Unit V Applications of Bionanotechnology 09 h

Principles, types and applications of Bionano-imaging, Magnetic nano-particles, nano-biosensors, biochips, biorobotics, nanopore technology and nanoarrays in medicine, agriculture, food and environmental science




## Text Books

- 1 Niemeyer, C.M. and Mirkin, C.A. 2004. Nanobiotechnology: Concepts, Applications and Perspectives. 1st Edition. Wiley-VCH, Germany
- 2 Shoseyov, O. & Levy, I. 2007. Nanobiotechnology: Bioinspired Devices and Materials of the Future. 1st Edition. Humana Press, USA

## References

- 1 Shah, MA and Shah, KA. 2019. Nanotechnology - The Science of Small. 2nd Edition. Wiley Sons, India
- 2 Poole, CP and Owens, FJ. 2020. Introduction to Nanoscience & Nanotechnology. 2nd Edition. Wiley India Pvt. Ltd., India.
- 3 Sanders, WC. 2018. Basics Principles of Nanotechnology. 1st Edition. CRC Press, USA.
- 4 Varghese, T and Balakrishna, KM. 2016. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials. 1st Edition. Atlantic Press, India.

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08.1.22	23.3.22	28.3.22





193BT1A6CP	BIOPROSPECTING, ENVIRONMENTAL BIOTECHNOLOGY & BIONANOTECHNOLOGY	SEMESTER VI
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Total Credits: 2

Total Instructions Hours: 60 h

S.No	Contents
1	Herbal bioprospecting – Phytochemical analysis of medicinal plants and its comparison
2	Medicinal bioprospecting - Preparation of different medicinal products
3	Marine Bioprospecting – Synthesis of useful products from the marine sources (eg. Agar from seaweeds)
4	Microbial Bioprospecting – isolation and identification of microbes producing useful metabolites (eg, Fungi/Bacteria).
5	Analysis of chloride content from ground water obtained from various parts of the city
6	Determination of Alkalinity present in different sources of water
7	Analysis of Acidity present in ground water from different sources
8	Determination of Chemical Oxygen Demand
9	Determination of MPN from the given water sample
10	Synthesis of Nanoparticles using herbal plants*
11	Spectral analysis of Nanoparticles obtained from herbal sources*
12	Antibacterial screening of metallic Nanoparticles.*

**Note:** \*DBT STAR college experiments




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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

## References

- 1 Choudhary, SS, Choudhary, P and Choudhary, SK. 2005. Laboratory Guide in Biosciences. 2nd edition. Kalyani publishers, India.
- 2 Reddy, SR and Charya MAS. 2012. Microbial Diversity: Exploration and Bioprospecting. 1st edition. Scientific Publisher.
- 3 Krishnan, S and Bhat. DJ. 2009. Plant and Fungal Biodiversity and Bioprospecting, Broadway Book Center, India.
- 4 Sharma, OP. 1996. Hills Economic Botany, Tata McGraw Hill co., Ltd., New Delhi.

		
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08.1.22	23.3.22	28.3.22





Course Code	Course Name	Category	L	T	P	Credit
193BT1A6SA	PHARMACEUTICAL BIOTECHNOLOGY	SEC	3			3

### PREAMBLE

This course has been designed for students to learn and understand

- The mechanism of drug action
- The production and application of new drugs
- The application of drugs and regulatory aspects

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn basic of Biopharmaceutical	K1
CO2	Understand the sources of Biopharmaceutical and therapeutic enzymes	K1, K2
CO3	Know the drug development process	K1, K2
CO4	Learn about Dosage forms, Manufacturing Principles and packing techniques	K1, K2, K3
CO5	Know the regulatory aspects with respect to clinical trials	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	M	S	S	S	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

193BT1A6SA	PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER VI
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Total Credits: 3

Total Instruction Hours: 36 h

### Syllabus

#### Unit I Introduction to Pharmaceuticals 7 h

Introduction- Biopharmaceuticals and pharmaceutical biotechnology; Physico-chemical properties of the drugs; Drug isolation and evaluation; Delivery of biopharmaceuticals-Oral, Pulmonary, Nasal, Transmucosal and Transdermal delivery system; Drug metabolism-Pharmacokinetics: Absorption, Distribution, Metabolism and Excretion (ADME) and Pharmacodynamics.

#### Unit II Sources of Biopharmaceuticals 8 h

Production of Biopharmaceuticals from Bacteria (E.coli), Yeast (Saccharomyces cerevisiae), Fungus (Penicillium Sp.), Insects, Transgenic plants and Animal cell culture. Therapeutic based pharmaceuticals - Anti-sense oligonucleotides (ASOs) and DNA aptamers, Growth Hormones (rhGH), Blood products (Cryoprecipitated AHF); Therapeutic enzymes (Ribozymes)

#### Unit III Drug Development Processes 7 h

Discovery and Development, Preclinical Research (Good laboratory practices approach - In-vitro & In-vivo), Clinical Research (Phase studies), Review of the drug, Post-Market Safety Monitoring.

#### Unit IV Dosage forms and Manufacturing Principles 7 h

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oral liquids, topical applications; preservation of drugs. Packing techniques, quality management.

#### Unit V Biopharmaceutical Regulatory Aspects 7 h

Roles and Responsibilities of the National and International Regulatory Authorities. Food and Drug Administration (FDA), Administrative Structure and Functions of Drug Regulatory Authorities in India-Central Drugs Standard Control Organization- Drug Controller General of India.






### Text Books

- 1 ChandrakantKokare. 2019. Pharmaceutical Biotechnology. 1st Edition. NiraliPrakashan, India.
- 2 Goodman & Gilman. 2006. The Pharmacological Basis of Therapeutics, PermagonPress, New York

### References

- 1 Muruges, N. 2014. A Concise text book of Pharmacology. 7th edition. Sathya Publications, India
- 2 Katzung, B.G. 1995. Basic and Clinical Pharmacology. 12th edition. Prentice Hall of Intl.
- 3 Goodman and Gilman. 2006. The Pharmacological Basis of Therapeutics. 11th edition. McGraw Hill Medical Publishing, India.
- 4 Lachman L Lieberman, HA, Kanig, J. 1986. Theory and Practice of Industry pharmacy. 3rd Edition. Varghese Publishing & Co, New Delhi.

		
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B.Sc. Biotechnology (Students admitted during the AY 2021-22)

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DA	DSE: GENOMICS	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The concepts of gene and its structure
- The basics of bioinformatics
- The techniques of gene sequencing and its importance

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gather information on basics of gene	K1
CO2	Acquire knowledge on different databases with regard to genes	K2
CO3	Gain insight on sequence alignment and gene finding tools	K2, K3
CO4	Understand gene structures and related databases and visualization tools.	K2
CO5	Highlight the applications of genome sequencing	K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	M	M	S

S Strong

M Medium

L Low



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B.Sc. Biotechnology (Students admitted during the AY 2021-22)



193BT1A6DA	DSE: GENOMICS	SEMESTER VI
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Biological Databases 10 h

Bioinformatics – Primary and secondary databases – Large scale molecular biology data - Types of biological databases – Nucleic acid sequence data bases (NCBI, EMBL, DDBJ), Protein sequence database - SWISS-PROT.

#### Unit II Genes and Chromosomes 10 h

Genes, genomes, genomics, chromosomes – characteristics. Genome diversity. Gene Bank – Classification of genomics (structural and functional). Structure, organization and composition of prokaryotic (bacteria), eukaryotic (yeast) and Plant genome

#### Unit III Genome Analysis 09 h

Access and retrieving genome project information from web – Comparative genomics. Identification and classification of genome using molecular markers, 16S rRNA typing/sequencing, Fragment Assembly and Expressed Sequence Tag (EST)

#### Unit IV Genome Sequencing 10 h

Sanger and Gilbert method - Next Generation Sequencing – Gene predictions. Gene Expression profiling. GENSCAN. Genomic and cDNA libraries. Northern blotting – In situ hybridization

#### Unit V Genome Projects and Applications 09 h

Human Genome Projects – HapMap project – ENCODE project. Genetic disorders diagnosis (Duchenne muscular dystrophy (DMD), Haemophilia). Synthetic genomes and their applications



Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DB	BIOETHICS AND BIOSAFETY	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The issues related to ethical framework
- Legal issues concerning biotechnology products and genes
- Classical examples of patented products

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gather knowledge about lab safety and committees involved	K1, K2
CO2	Understand the role of bioethics in the field of biotechnology and its products	K2, K3
CO3	Gain insight on types of IPR and its licensing	K3
CO4	Imbibe art of patenting and strategies involved.	K3
CO5	Highlight the global scenario on IPR	K2, K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong

M Medium

L Low



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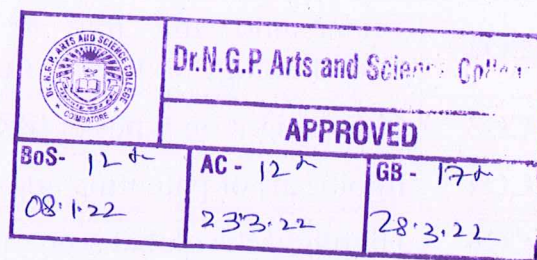


## Text Books

- 1 AH wood, T.K. Parry smith D. 2001. Introduction to Bioinformatics. Pearson education Asia
- 2 Rastogi S C. 2008. Bioinformatics Methods and Applications: Genomics Proteomics and Drug Discovery. 3rd edition, PHI Learning Pvt. Ltd., India.

## References

- 1 Primrose, S.B. and Twyman, R.M. 2004. Principles of gene manipulation and Genomics, 2nd edition, Blackwell Publishing Ma, USA
- 2 Dale, W. J and Schantz M. 2014. From Genes to Genomes. 3rd edition, Wiley, John & sons
- 3 Ridley, M. 2019. Genome: Autobiography of a species in 23 chapters. 1st edition, Harper Perennial Publishing, USA
- 4 Quackenbush, J. 2011. The Human Genome. 1st edition, Curiosity Guides, USA



193BT1A6DB	BIOETHICS AND BIOSAFETY	SEMESTER VI
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Biosafety Basics 9 h

Good Lab Practices, Introduction to Biological Safety Cabinets, Primary Containment for Biohazards, Biosafety Levels, GMOs and LMOs and their environmental impact, Roles of Institutional Biosafety Committee, RCGM, GEAC

#### Unit II Genes and Bioethics 9 h

Bioethical issues related to Healthcare & medicine Food & agriculture. Genetic engineering, Human Genome Project. Genetic Testing, types, pros and cons, informed consent. Socio-economic problems and environmental problems relating to bioethics

#### Unit III Copyright and Patents 10 h

Definition, Concept of Intellectual Property, Kinds of Intellectual Property Patents, Copyrights, Designs, Trademarks, Geographical Indication, Infringement of IPR, protection and Remedies, Licensing and its types

#### Unit IV Features of Patenting 10 h

Requirement of patentable novelty, Inventive step, Prior art Classifying products as patentable and non-patentable, Procedure for applying for patent, Patent Infringement and related case studies Biological Patentability. Biopiracy and Bioprospecting. Farmers Rights and Plant breeders rights Biodiversity

#### Unit V Patented Products 10 h

Traditional knowledge and patent issues with relevance to Indian context. Basmati rice patent case, turmeric patent case, Neem leaves patent, superbug patenting






## Text Books

- 1 DeepaGoel. 2013.IPR Biosafety and Bioethics,1stedition. Pearson Education
- 2 Sateesh, M.K. 2008.Bioethics and Biosafety. 1st Edition. I.K. International Publishing House

## References

- 1 Catherine J. Holland. 2007. Intellectual Property: patents, trademarks, copyrights, trade secrets. 1st edition. Entrepreneur Press.
- 2 Srinivasan, K. and Awsthi, H.K. 1997. Laws of Patents. 1st edition. Jain Book Agency.
- 3 Thomas H. Murray and Maxwell J. Mehlman. 2005. Encyclopedia of Ethical, Legal and Policy issues in Biotechnology. 1st edition. Wiley Interscience.
- 4 Biosafety Manual by WHO.  
<https://www.who.int/csr/resources/publications/biosafety/LabbiosafeMicrosoft Word - LBM2+ final for pdf.doc> (who.int)

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DC	DSE II: DRUG DESIGN & DELIVERY	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The study of drug design, development and delivery systems
- The Cheminformatics and its Application in Drug Development
- The Computer Aided Drug Design (CADD) and its role

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the Drug Design and Development, Role of Organic Chemistry, SAR & SQAR	K1, K2
CO2	Learn the Targets Based Drug Design	K1, K2
CO3	Impart knowledge on the pharmacophore, application of cheminformatics in Lead Compound Discovery	K2, K3
CO4	Know the Computer Aided Drug Design (CADD), tools, SBDD & LBDD	K2, K3
CO5	Learn the Various Target Based Drug Delivery Systems, Challenges and obstacles in drug delivery	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	M	S	S

S Strong

M Medium

L Low



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193BT1A6DC	DSE II: DRUG DESIGN & DELIVERY	SEMESTER VI
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Introduction to Drug Design 9 h

Introduction to Drug Design and Discovery, History and Evolution of the contemporary drug discovery process. Role of organic chemistry in Drug Discovery, Design and Development. Molecular properties and interactions of drug molecules. Structure Activity Relationships (SAR) and Quantitative SAR (QSAR) techniques in drug design.

#### Unit II Drug Design 9 h

Types of Drug design and Drug development, difference between drug design and drug development. Classical Targets in Drug Discovery - Enzymes, Inhibition of Enzymes, G-Protein-Coupled Receptors (GPCRs), Ion Channels and Membrane Transport Proteins (Transporters).

#### Unit III Cheminformatics 10 h

Cheminformatics - Introduction to pharmacophore, concepts in CADD, methods in docking simulations, Applications in ADME-tox and Limitations. Role of Cheminformatics and Molecular Diversity in Lead Discovery. Sources of Lead Compounds, Screening, Identification, Modification and Lead Optimization.

#### Unit IV Computer Aided Drug Design (CADD) 10 h

Introduction and classification of CADD. Drug design based on bioinformatics tools, Molecular docking, De novo design, Structure Based Drug Design (SBDD) and Ligand Based Drug Design (LBDD). Challenges and emerging problems in CADD, Legal & ethical considerations in drug development.

#### Unit V Drug Delivery & Drug Delivery Systems 10 h

Introduction to drug delivery and targeting systems. Controlled drug release, parenteral and non parenteral routes of drug delivery and targeting - Oral, buccal, sublingual, GI tract, transdermal, nasal and pulmonary drug delivery. Gene delivery systems and Vaccine delivery. Challenges and obstacles to targeted drug delivery.




## Text Books

- 1 MohaneCoumar. S. 2021. Molecular Docking for Computer-Aided Drug Design: Fundamentals, Techniques, Resources and Applications. 1st edition. Academic Press, USA.
- 2 Anees Ahmad Siddiqui. Harish Kumar. SubuhiKhisal. 2020. Computer-Aided Drug Design. 1st edition. CBS Publishers, USA.

## References

- 1 RamaraoPoduri. 2021. Drug Discovery and Development from Targets and Molecules to Medicines. 1st edition. Springer, USA
- 2 Tarun Bhatt. SurendraNimesh. 2021. The Design and Development of Novel Drugs and Vaccines. 1st edition. Academic Press, USA
- 3 Osman F Guner. 2020. Pharmacophore Perception, Development, and Use in Drug Design. 1st edition. TBS Publishers, USA
- 4 Anya M Hillery. Kinam Park. 2017. Drug Delivery Fundamentals and Applications. 2nd edition. CRC Press, USA

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DD	DSE:PROTEOMICS	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals of Proteomics
- The Quantitative Proteomics and its applications
- The advancements in Proteomics

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gather knowledge on basics of proteomics	K1
CO2	Acquire knowledge about gel based proteomics and its applications	K1,K2
CO3	Understand the principle and concept of Mass Spectrometry	K2,K3
CO4	Gain insight on methods of Quantitative proteomics	K2,K3
CO5	Highlight the advancements in proteomics	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S

S Strong

M Medium

L Low



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193BT1A6DD	DSE: PROTEOMICS	SEMESTER VI
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Introduction to proteomics 9 h

Introduction to amino acids – structure and isomerism, ionisation state, cis and trans forms. Introduction to proteins – Structural levels and Ramachandran Plot, X-Ray Crystallography, 3D structure determination through amino acid sequence. Properties of protein, Prediction of Protein structure, folding, misfolding and Molecular Chaperones.

#### Unit II Gel based Proteomics 9 h

Sample preparation and pre-analytical factors, Protein fractionation, extraction and quantification, One- dimensional electrophoresis, 2-DE: Second dimension, Gel analysis and Applications. 2D-DIGE: Basics, Data Analysis and Applications. Systems biology and proteomics.

#### Unit III Mass Spectrometry 10 h

Chromatography technologies, Liquid chromatography, Mass spectrometry- Fundamentals, Ionization sources, Mass analyzers, MALDI sample preparation and analysis. Hybrid mass spectrometry configurations, in-gel & in-solution digestion

#### Unit IV Quantitative Proteomics 10 h

Introduction to quantitative proteomics – Relative and Absolute Quantification, Label Free Quantification- Spectral Counting. Gel based quantitative proteomics – Fluorescence 2-D Difference Gel Electrophoresis (FDIGE) and Labelled Quantification - In vivo labeling (SILAC& TAILS) and In vitro labeling (iTRAQ& TMT).

#### Unit V Advancements in Proteomics 10 h

Functional Proteomics, Interaction proteomics- Biochemical approaches: Direct analysis, affinity purification and protein chips. Applications of proteomics in OMICS and its translational research (Transcriptomics, Metabolomics, Metabonomics and Neutriproteomics). Challenges in Proteomics.






## Text Books

- 1 Twyman, RM. 2004. Principles of Proteomics, BioScientific Pub.
- 2 Liebler, DC. 2002. Introduction to Proteomics: Tools for the New Biology. Humana Press, USA.

## References

- 1 Veenstra, TD and Yates, JR. 2006. Proteomics for Biological Discovery. John Wiley & Sons, USA.
- 2 Hubert, R.  
2006. Protein Biochemistry and Proteomics (The Experimenter Series), Academic Press, USA
- 3 Westermeier, R. Naven, T. Höpker, HR. 2008.  
Proteomics in Practice: A Guide to Successful Experimental Design. Wiley-VCH, USA.
- 4 Twyman, R. 2014. Principles of Proteomics. 2nd Edition. Taylor and Francis Group, UK.

		
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Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DE	BIOMARKER TECHNOLOGY	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The application of markers in biology
- The biosensing devices and their working
- The technological advancement in biomarkers

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts on markers	K2
CO2	Value the importance of proteomics and genomics	K2,K3
CO3	Comprehend the transcriptome and its role	K3
CO4	Diagnose the diseases and cures using biomarkers	K3
CO5	Understand the applications of biomarkers	K2,K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong

M Medium

L Low



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193BT1A6DE	BIOMARKER TECHNOLOGY	SEMESTER VI
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Total Credits: 4

Total Instruction Hours: 48 h

## Syllabus

**Unit I** Basics about Biomarkers 09 h

Introduction - history - milestones - biomarkers. Types of biomarkers in the biological sciences. Genomics - Proteomics - Transcriptomics - Metabolomics relating to biomarkers

**Unit II** Types of Biomarkers 09 h

Analysis of proteins - Analysis of transcripts - study of RNA profiling - identification of genomic DNA - comprehension of metabolites and intermediary products

**Unit III** Biomarkers Databases 10 h

Biomarker Databases - MarkerDB -clinical and therapeutic decision making - gobiomdbplus (comprehensive database) - Charles River database

**Unit IV** Biomarkers in Drug Development 10 h

Screening markers - toxicity markers - efficacy markers - drug development using biomarkers - disease management with examples

**Unit V** Applications of biomarkers 10 h

Prediction of diseases - diagnostics uses - prognostic applications - staging markers - safety biomarker - susceptibility biomarker - case studies relating to different types of biomarkers in diseases



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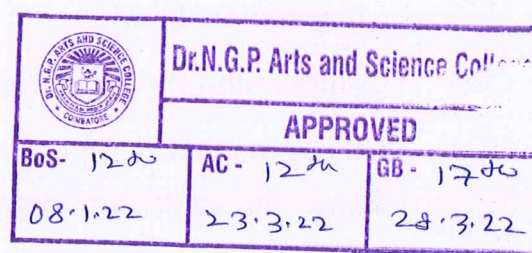
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## Text Books

- 1 Veenstra, TD and Yates, JR. 2006. Proteomics for Biological Discovery. John Wiley & Sons, USA
- 2 Hubert, R. 2006. Protein Biochemistry and Proteomics (The Experimenter Series), Academic Press, USA

## References

- 1 Dale, W. J and Schantz M. 2014. From Genes to Genomes. 3rd edition, Wiley, John & sons
- 2 Ridley, M. 2019. Genome: Autobiography of a species in 23 chapters. 1st edition, Harper Perennial Publishing, USA
- 3 James Watson D, 2001, "Recombinant DNA technology". 2nd Edition, WH Freeman and company, United Kingdom
- 4 Campbell, A.M. and L. J. Heyer, 2007, "Discovering Genomics, Proteomics and Bioinformatics", 2nd Edition, Pearson Education





Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DF	DSE: STEM CELL TECHNOLOGY	DSE	3	1	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The features of Stem Cell, Pluripotency and Reprogramming of stem cells
- The differentiation and tools to study stem cells
- The clinical applications of Stem Cell Biology

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the establishment of embryonic stem cells	K1, K2
CO2	Understand in vitro differentiation, specification and computational tools	K2
CO3	Comprehend the regulatory mechanism in stem cells	K3
CO4	Highlight clinical application of stem cell technologies	K3
CO5	Know the ethics of premature translation of stem cell interventions	K2,K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	M
CO5	S	S	M	M	S

S Strong

M Medium

L Low



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193BT1A6DF	DSE :STEM CELL TECHNOLOGY	SEMESTER VI
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Introduction to stem cell 9 h

Introduction to Stem cells - In vivo and In vitro. Development of stem cells- Early development, Gastrulation and lineage commitment, cell fate, Specification and development of primordial germ cells. Human stem cells and plasticity of human stem cell research, cord blood stem cell and stem cell marker.

#### Unit II Pluripotency and Reprogramming 9 h

In vitro stem cell regeneration - Establishment of embryonic stem cells (ESCs), Characterization of pluripotent stem cells (PSCs), Molecular mechanisms underlying pluripotency, Induction of pluripotency, Potential of induced pluripotent stem cells (iPSCs) in basic and clinical applications, Alternative PSCs. Reprogramming using defined factors and mechanisms of reprogramming.

#### Unit III Differentiation of Stem cells and its tools 10 h

In vitro differentiation, Specification during development in adults, Trans differentiation and direct programming. Computational tools to dissect stem cell heterogeneity, In vitro cultures of adult stem cells to analyze differentiation capacity.

#### Unit IV Regulatory mechanism in Stem cells technology 10 h

Core regulatory circuitry, DNA methylation, Histone modifications, histone modifiers, chromatin remodelers, Spatial organization of genome during ESC development and differentiation. Generation of chimeric animals and animal cloning; Pro-nuclear injection of blastocysts, transplantation of blastocysts into pseudo-pregnant mice and generation of chimeric and knockout animals.

#### Unit V Clinical Applications of stem cell technology and ethics 10 h

Clinical application of stem cell technologies with reference to adult stem cell disease modeling and therapy. Stem cell therapy guidelines and clinical trials. Embryo ethics - ethics of egg donation, premature translation of stem cell interventions, fetal tissue. Access to future stem cell therapies and awareness to the public.






## Text Books

- 1 Meshorer, E and Plath, K. 2010. The Cell Biology of Stem Cells. Springer Science+ Business media. LLC.Landes Biosciences, Germany.
- 2 Kallosm M.S. 2011. Embryonic Stem Cells - Basic Biology to Bioengineering. Intech Open Access Publisher, UK

## References

- 1 Clarke, M. and Frampton, J. 2020. 1st Edition. Core Concepts in Stem Cell Biology. Routledge Taylor & Francis Group, UK.
- 2 Lanza, R. and Atala, A. 2014. Essentials of Stem Cell Biology. Elsevier, Netherlands.
- 3 Li, S., Herureux, N.L., Elisseff, J. 2011. Stem Cell and Tissue Engineering. 1st Edition. World Scientific Publishers, Singapore.
- 4 Slack, J.M.W. 2017. The Science of Stem Cells. John Wiley & Sons, Inc., USA

		
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Course Code	Course Name	Category	L	T	P	Credit
193BC1A6AA	INNOVATION, IPR AND ENTREPRENEURSHIP	AECC	2	-	-	2

### PREAMBLE

This course has been designed for students to learn and understand

- The role of Entrepreneurship in Economic Development and basics of Intellectual Property Rights, Copy Right Laws, Trade Marks and Patents
- Ethical and professional aspects related to intellectual property law context
- Intellectual Property(IP) as an career option

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of innovation, IPR, entrepreneurship and its role in economic development	K2
CO2	Know the value , purpose and process of Patent	K2
CO3	Understand the basics of trademarks and industrial designs	K2
CO4	Acquire knowledge about copyright and copyright law	K2
CO5	Identify Geographical Indications	K2

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong

M Medium

L Low



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193BC1A6AA	INNOVATION, IPR AND ENTREPRENEURSHIP	SEMESTER VI
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Total Credits: 2

Total Instruction Hours: 24 h

### Syllabus

#### Unit I Introduction to Innovation, IPR and Entrepreneurship 05 h

Meaning of Creativity, Invention and innovation - Types of Innovation - Introduction and the need for Intellectual Property Right (IPR) - Kinds of IPR - National IPR Policy. Entrepreneurs-Concept, characteristics, Functions, need and types, Entrepreneurial decision process. Role of Entrepreneurship in Economic Development.

Case Study: Jayabharati Viswanath: A case of Ladel to Leather.

#### Unit II Patents 05 h

Introduction and origin of Patent System in India- Conceptual Principles of Patent Law in India - Process for obtaining patent - Rights granted to a Patentee - Infringement of Patent.

Case Study: When Google was used for Patent Infringement.

#### Unit III Trademarks 05 h

Origin of Trade Marks System - Types - Functions - Distinctiveness and Trademarks - Meaning of Good Trademark - Rights granted by Registration of Trademarks - Infringement of trademark.

Case Study: Trademark mismanagement by Cadbury's.

#### Unit IV Copyright 05 h

Introduction and Evolution of Copyright - Objectives and fundamentals of Copyright Law - Requirements for Copyrights - Works protectable under Copyrights - Authorship and Ownership - Rights of Authors and Copyright owners - Infringement of Copyright.

Case Study: Copyright Case of Napster and Grokster.

#### Unit V Geographical Indications 04 h

Introduction and Concept of Geographical Indications - History - Administrative Mechanism - Benefits of Geographical Indications - Infringement of registered Geographical Indication.

Case Study: The story of the Tirupati Laddu.

**Note:**Case studies related to the above topics to be discussed (Examined internal only)



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## Text Book

- 1 Nithyananda, K V. 2019, "Intellectual Property Rights, Protection and Management", Cengage Learning India Private Limited, New Delhi, India.
- 2 Dr. S. S. Khanka, 2020, "Entrepreneurial Development", S Chand and Company Limited, New Delhi, India.

## References

- 1 Ahuja, V K. 2017, "Law relating to Intellectual Property Rights", 3rd Edition, Lexis Nexis, Gurgaon, India.
- 2 Neeraj, P., & Khusdeep, D., 2014, "Intellectual Property Rights", 1st Edition, PHI Learning Private Limited, New Delhi, India.
- 3 <http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf>.
- 4 <https://knowledgentia.com/knowledgate>.

*[Signature]*  
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