

**JSS Academy of Higher Education & Research** 

(Deemed to be University) Accredited "A" Grade by NAAC Sri Shivarathreeshwara Nagar, Mysuru - 570 015

## Solution in the second **Regulation & Syllabus**

### **UNDER GRADUATE DEGREE PROGRAMMES-2018**



### **Regulation & Syllabus**

### UNDER GRADUATE DEGREE PROGRAMMES

### 2018



JSS Academy of Higher Education & Research (Deemed to be University) Accredited "A" Grade by NAAC Sri Shivarathreeshwara Nagar, Mysuru – 570 015

### Preamble

The Department of Water and Health under Faculty of Life Sciences offers undergraduate and postgraduate programs and one postgraduate diploma program under the UGC-CBCS pattern. The CBCS pattern offers a platform for interdisciplinary learning among our students. This pattern provides choice for students to select from the prescribed courses (core, elective, soft skills). Under this CBCS, the requirement for awarding a degree or diploma is prescribed in terms of number of credits to be completed by the students. The courses offered has a mandate to coordinate the UGC regulations in a manner that uniform quality control regulations and procedures are strictly adhered to and high academic standards are maintained, in addition to providing our students with high quality academic, ICT,

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The Semester Grade Point Average (SGPA) is measured as performance of work done by the student in a semester. The Cumulative Grade Point Average (CGPA) is measured as cumulative performance of a student in all semesters in the courses taken by the student.

The mission of the undergraduate and postgraduate studies offered at FLS is to promote excellence amongst our undergraduate and postgraduate staff and students through responsive teaching, research and supervision, scholarship and instructional pastoral support. The main objective of the courses offered at FLS is interdisciplinary in nature that enables over all student development and enhanced learning experience. Each course paper provides hands-on-experience that translates theory to practicals. The curriculum is supported with field trips, industrial visits and other extension and extracurricular activities wherever required.

lated workshops, research centers and national/international laboratories with inter and multidisciplinary collaborative research The students are encouraged to undergo and acquire scientific knowledge by frequently participating in different subject regroups.

# UNDER GRADUATE PROGRAMS AND REGULATIONS

SI.No.	Name of the Program	<b>Program Genesis</b>
1	B.Sc. Environmental Sciences	2013-2014
2	B.Sc. Microbiology	2013-2014
Э	B.Sc. Biotechnology	2013-2014
4	B.Sc. Food, Nutrition and Dietetics	2017-2018
5	B.Sc. Psychology	2018-2019

			B.Sc Prog	Jrams	
raper ue- tails	Biotechnology	Microbiology	Environmental Science	Food, Nutrition and Dietetics	Psychology
			SEMESTER I		
Language-I	Part I: English I	Part I: English I	Part I: English I	Part I: English I	Part I: English I
Language-II	Part II: English I/ Kannada I	Part II: English I/Kannada I	Part II: English I/ Kannada I	Part II: English I/ Kannada I	Part II: English I/Kannada I
Core Paper-I	Cell Biology	Fundamentals of Microbiology	Introduction to Environmental Sciences	Introduction to Food and Nutri- tion	General Psychology I
Practical	Core Practical I	Core Practical I	Core Practical I	Core Practical I	Core Practical I
Allied Pa- per-I	Basics of Biosta- tistics	Basics of Biosta- tistics	Basics of Biosta- tistics	Basics of Biosta- tistics	Basics of Biostatistics
Practical	Allied Practical I	Allied Practical I	Allied Practical I	Allied Practical I	Allied Practical I
Compulsory Paper	Environmental Studies	Environmental Studies	Environmental Studies	Environmental Studies	Environmental Studies
			SEMESTER I		
Language-I	Part I: English II	Part I: English II	Part I: English II	Part I: English II	Part I: English II
Language-II	Part II: English II/ Kannada II	Part II: English II/Kannada II	Part II: English II/Kannada II	Part II: English II/Kannada II	Part II: English II/Kannada II
Core pa- per-II	Microbiology	Microbial Diver- sity	Ecosystem Dy- namics	Applied Physiol- ogy	General Psychology II
Practical	Core Practical II	Core Practical II	Core Practical II	Core Practical II	Core Practical II
Allied Pa-	Principle of Bio-	Principle of Bio- chemistry	Principle of Bio- chemictur	Principle of Bio-	Nutritional and Health Psychol-
Practical	Allied Practical II	Allied Practical II	Allied Practical II	Allied Practical II	Allied Practical II
			SEMESTER II	н	
Language-I	Part I: English III	Part I: English III	Part I: English III	Part I: English III	Part I: English III

**Overview of B.Sc Programs curriculum** 

Language-II	Part II: English III/Kannada III	Part II: English III/Kannada III	Part II: English III/Kannada III	Part II: English III/Kannada III	Pa
Core Pa- per-III	Biochemistry	Microbial Physi- ology	Components of Biodiversity & Conservation	Public Health Nu- trition	D
Core Pa- per-IV	Classical Genetics	Microbial Genet- ics	Natural Resources	Principles of Hu- man Nutrition	S
Practical	Core Practical III	Core Practical III	Core Practical III	Core Practical III	C
Allied Pa- per-III	Bioinformatics	Bioinformatics	Bioinformatics	Bioinformatics	Bi
Practical	Allied Practical III	Allied Practical III	Allied Practical III	Allied Practical III	
Skill based-I	Basics of Comput- ers	Basics of Com- puters	Basics of Com- puters	Basics of Comput- ers	Ва
			SEMESTER I	/	
Language-I	Part I: English IV	Part I: English IV	Part I: English IV	Part I: English IV	Pa
Language-II	Part II: English IV/Kannada IV	Part II: English IV/Kannada IV	Part II: English IV/Kannada IV	Part II: English IV/Kannada IV	Pa
Core Pa- per-V	Molecular Genet- ics	Microbial Metab- olism and Tech- nology	Environmental Microbiology	Dietetics	D
Practical	Core Practical IV	Core Practical IV	Core Practical IV	Core Practical IV	C
Allied Pa- per-IV	Fundamentals of Nanotechnology	Fundamentals of Nanotechnology	Fundamentals of Nanotechnology	Fundamentals of Nanotechnology	Ps
Practical	Allied Practical IV	Allied Practical IV	Allied Practical IV	Allied Practical IV	A
Skill based- II	Tissue Culture	Tissue Culture	Tissue Culture	Tissue Culture	Er
			SEMESTER V	'	
Core Pa- per-VI	Immunology	Principles of Im- munology	Environmental Chemistry	Food Preservation and adulteration	A
Core Pa- per-VII	Plant and Animal Biotechnology	Recombinant DNA Technology	Environmental Pollution	Principles of Meal Planning through life cycle	In
Core Pa- per-VIII	Medical Microbiol- ogy	Medical Microbi- ology	Environmental Monitoring and Techniques	Food Service Management	EI W
Practical	Core Practical V	Core Practical V	Core Practical V	Core Practical V	C
Elective Pa- per-I	1A. Water & Waste Water Treatment; 1B. Environmental Biotechnology; 1C. Age Medical Biotechnology; 1E. Fermentation Technology; 1F. Microbial Culture Tech giene; 1H. Nutrition and sports and fitness: 1I. Foundations of Guidance and Co				
Skill based- III	Advanced Instru- mentation Tech- niques	Advanced Instru- mentation Tech- niques	Advanced Instru- mentation Tech- niques	Advanced Instru- mentation Tech- niques	Н
SEMESTER VI					

Coro Pa-	Environmontal	Environmental	Environmontal			
per-IX	Biotechnology	and Agricultural	Management	Nutraceuticals	Pł	
					$\vdash$	
Core Pa- per-X	Recombinant DNA Technology	Food, Dairy and Industrial Micro- biology	Eco-restoration and Development	Food Microbiology	A	
Practical	Core Practical VI	Core Practical VI	Core Practical VI	Core Practical VI	C	
Elective Pa- per II	2A. Ecotourism; 2B. Environmental Toxicology; 2C. Bio- Processing & Separatio plication in Waste Water Management; 2E. Bioethics & Bio-safety; 2F. Microbial packaging; 2H. Food Product Development and Quality Control; 2I. Psychology					
Elective Pa- per III	3A. Solid Waste Management; 3B. Hydrology; 3C. Genomics & Proteomics; 3D. Vermiculture Technology; 3F. Biopesticide & Biofertilizer; 3G. Food toxicology; 3 itation Psychology					
	Extension activi- ties	Extension activ- ities	Extension activi- ties	Extension activi- ties	E>	
UNDERGRADUATE PROGRAMME REGULATIONS						

### I. Definitions

### **1. Programme and Course:**

- a. Programme: UG Degree Programme
- b. Course: A theory or a practical or a project work or a combination of all as said above, studied in a semester.
- **2. Faculty:** A teaching member recognised by UGC.
- **3. Head of the Department:** A recognised Faculty of the respective department nominated by the Dean in consultation with the Vice Chancellor.
- **4. Semesters:** There are two semesters in a year. The semester that begins in July (July to November) is known as Odd semester and the semester that begins in December (December to April) is known as Even Semester and the summer vacation is from May to June.

### II. Programme Study:

- 1. **Curriculum:** Every Department has a prescribed course structure, which in general terms is known as Curriculum/Course of Study/Programme. It prescribes courses to be studied in each semester. This includes all the curricula and course contents. Except for the language curricula, for all other curricula the medium of the instruction, examination, seminar and project work should be in English.
- 2. Credit System: In general a certain quantum of work measured in terms of credit is laid down as the requirement for a particular degree. The student acquires credits by passing courses every semester. There are mainly two types of courses: i) Laboratory courses consisting of theory and practical and ii) Non-laboratory courses consisting of only theory papers. The credit (C) for a course/paper is dependent on the number of hours of instruction per week in that programme. Credits are assigned to practical training, Seminar and projects also. The quantum of credits for such activities are stipulated by respective programme committee of the department, which on subsequent CBCS meeting chaired by the Vice Chancellor, approval will be done. It is mandatory that the HOD must have placed the same and got it approved by

the Board of Studies prior to the CBCS meeting.

ysiological Psychology **3. Duration and Structure of the Programme:** 

The minimum and maximum periods for completion of a programme are given below: phormal Psychology-II

### Eligibility, Structure and Duration of the UG Courses

pre Practical Vlandidate for admission to the first year of the UG degree programme shall be n; 2D. BiotecheplogicateAppave bassed the higher secondary examination/II PUC /10+2/any Diseases Control valent Food life ation as prescribed by UGC and other examinations accepted as for Exceptioned with the there to by board of management of JSS Academy of Higher Education Industrial Biotel from tody; 3E.

H. Food analysis; 3I. Rehabil-Maximum No. SI. Programmes No. of of Semester Remarks tension activities Semester (to complete the Program) 1. **Full Time** B. Sc 1.a 6 9 Minimum two se-1.b B.A, B.Com., BBM, BCA 6 9 mester/year with 2. Part Time 90 working days in each semester 2.a B.Sc 8 11 B.A, B.Com., BBM, 8 2.b 11

> The minimum number of credits required for the successful completion of the 3 years full is 56. Registration for 140 credits is compulsory and in each paper students has to secure minimum 40 percent marks to pass respective paper.

### 4. Credit Assessment:

BCA

One credit is assigned for each lecture of one-hour duration per week. (A 4 credit course will need 4 one hour lecture in one week). Two hours of practical session in a week is equal to one credit (for 1 credit practical course will need 2 hours of practical). The minimum and maximum numbers of credits, a candidate has to be registered in a semester are given below.

Credits				
SI. No.	Semester	<b>Minimum Credits</b>	<b>Maximum Credits</b>	
1	First	17	21	
2	Second	25	29	
3	Third	23	27	
4	Fourth	29	33	
5	Fifth	20	24	
6	Sixth	26	30	
	Total	140	164	

### III. **Registration:**

1. **Registration Procedure:** The student is requested to register for opted courses/Papers with the respective faculty, after due announcement of the prescribed dates and at the beginning/commencement of each semester. The HOD/concerned faculty member will inform the students the list of electives, supportive courses and skill based courses available for the students for registration. The procedure is as follows:

- i. The registration of courses for the semester(s) other than the first semester shall be made at least one week prior to the end-semester examination of the previous semester.
- ii. The details of the core, elective and supportive courses, and the Project shall be intimated to the students, prior to the date of registration.
- iii. The registration form shall be filled in and signed by the student and the concerned teacher.
- iv. A student may be granted permission to withdraw from a course earlier registered by him/her within two weeks (or in the event of absenting himself/herself for more than two weeks) from the date of commencement of the semester.
- v. A student who has withdrawn his/her registration for a specific course may register for that course again when the same course is offered by the department concerned, in subsequent semester.

### 2. Temporary withdrawal of registration:

A student may be permitted by the Dean of the faculty on the recommendation of the chairperson of the Programme Committee and the Head of the Department concerned to temporarily withdraw from the programme up to a maximum of two semesters for valid grounds.

### **IV.** Programme Committee:

- 1. Every Programme shall have a Programme Committee constituted by the HOD in consultation with all the Courses Teachers of the corresponding programme.
- 2. The composition of the Programme Committee shall be as follows: Among the faculty member will be the Chairperson; Teachers of all courses of the corresponding programme; Student Adviser and two student representative of the programme (one in I year and other in II year), nominated by the Head of the Department.
- 3. Duties of the Programme Committee:
  - i. Reviewing periodically the progress of the classes.
  - ii. Discussing the problems concerning curricula, syllabi and the conduct of classes.
  - iii. Providing consultation of the Course Teachers on the nature and scope of assessment for the course, this shall be announced, to the students at the beginning of respective semesters.
  - iv. Communicating its recommendation to the Head of the Department on academic matters.
  - v. The Programme Committee shall meet at least thrice in a semester preferably at the end of each internal continuous assessment tests and before the final end semester Exam.

### V. Attendance:

- 1. No candidate who has put in less than 75% of the full attendance for the course shall be permitted to take the semester examination of the course concerned.
- 2. On the day on which a course is concluded, the Course Teacher of the course shall intimate the Head of the Department, the particulars of total class hours, hours attended and percentage of attendance of all students, who have shortage of attendance in the course offered by him/her.
- 3. The Head of the Department shall announce the names of all students who will not be eligible to take the end semester examination in the various courses due to shortage of attendance.
- 4. Condonation of shortage of attendance will be permitted up to 10% after paying the prescribed fee.
- 5. Students having less than 65% of the attendance are directed to reregister for the respective course again to compensate the short-fall in attendance.

### VI. Examination:

### A. Continuous Internal Assessment (CIA)

- 1. The Continuous Internal Assessments may be in the form of a combination of periodical tests (three), assignments (two) and seminar (one).
- 2. The assessment procedure to be followed for each course shall be approved by the Programme Committees and announced by it to the students at the commencement of each semester by the Course Teacher.
- 3. Such schedule for continuous assessment procedure will be displayed on the notice board in the beginning of the semester.
- 4. The course teacher shall intimate the internal marks of the candidates and their attendance detail to the student through notice board.
- 5. The HOD will send the internal assessment marks together with attendance secured by each candidate and forward to Controller of Examinations office. Based on this detail and CBCS regulations, the Controller of Examinations will issue Hall ticket for semester examination, through HOD.

Examination	Assessment	Marks %
Test	Average of best two test performance	40
Assignment	Average of the two submitted	20
Seminar	Presentation on a given topic	20
Attendance		20

### DETAILS OF SESSIONAL ASSESSMENT/INTERNAL ASSESSMENT (25 MARKS)

The question paper for the test, topic of the assignments and seminar will be assigned by the respective course teacher. All tests will be conducted only on prior notice in the respective departments. The exact date and timing will be announced by the HOD at the start of the semester. The internals for attendance is as follows:

65-75% of attendance / ser	mester	1 mark
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75-85% of attendance	2 marks
85-90% of attendance	3 marks
90-95% of attendance	4 marks
95-100% of attendance	5 marks

### B. End Semester Examination (ESE):

- 1. There shall be one end semester examination (ESE) of three hours duration on each lecture based course.
- 2. For practical examination, the duration shall be fixed minimum 3 hours and may be extended depends on the course.
- 3. The end semester examination is compulsory for all students and evaluated by the office of the Controller of Examinations following double evaluation system.

### VII. Weightages:

For Lecture based courses (Non-laboratory)	
Continuous Internal assessment	- 25 %
End – Semester	- 75%
For laboratory based courses / Practical	
Sessional Assessment	- 25%
End – Semester Examination	- 75%
	For Lecture based courses (Non-laboratory) Continuous Internal assessment End – Semester For laboratory based courses / Practical Sessional Assessment End – Semester Examination

### VIII. Supplementary Examination:

- 1. Students who have missed CIA on valid reason may apply for retests to the Course Teacher concerned specifying the reason for the absence and the Course Teacher shall conduct a retest when satisfied with the validity of the reasons given for the absence. Such conduct must get the approval from the HOD.
- 2. Students who have missed the end-semester written examinations on valid reason like hospitalization or accidents may make an application for supplement examination duly recommended by the HOD to the head of the Department within five days from the date of examination missed. The same may be communicated to the Controller of Examinations within 7 working days and the Controller of Examinations may conduct the supplementary examination within a month after paying the prescribed fee.
- 3. A candidate who has failed in one or more subjects in the previous semesters should be cleared six month before the end of the final year semester.

### IX. Course wise Grading of Students Letter Grades:

- 1. Based on the performance, each student shall be awarded a Final Letter Grade at the end of the each semester in each course and overall grade in the final semester.
- 2. The letter grades and their corresponding grade points are as follows:

Grade Points	Lower Limit	Upper Limit	Range	Grade
4	30	39	30≥P<40	NA/I-Inadequate Attendance
5	40	49	40≥P<50	E
6	50	59	50≥P<60	D
7	60	69	60≥P<70	С

8	70	79	70≥P<80	В
9	80	89	80≥P<90	A
10	90	100	90≥P<100	0

The Semester end Grade point average (SGPA) and the Course end Cumulative Grade Point Average (CGPA) are computed as follows:

The Cumulative Point (CP) in a said course may be calculated by using the formula  $CP = C \times GP$ , where C is the Credit Value of the said course

### GP is Grade Point

### The SGPA may be calculated as follows:

SGPA = Sum of all CPs in the said semester/Sum of Credits in the said semester The CGPA may be calculated as follows:

CGPA = Sum of CPs in all the semesters/credits for the said programme The CGPA may be expressed to an accuracy of three decimal digits The percentage equivalence may be obtained by multiplying CGPA by 10.

- The above grading is done by Controller of Examinations office after taking into account both internal (Continuous assessment) marks together with end semester marks.
- 4. No student is considered to have completed a course successfully and earned the credits when he / she secure a Letter Grade of "NA" or "I".
- 5. A Letter Grade of "NA" in any course implies the incompletion of that course.
- 6. A course successfully completed can be repeated for the purpose of improving Cumulative Grade Point Average by re - registration.

### X. Method of awarding letter grades:

- 1. In a reasonable time frame, the Controller of Examinations office will scrutinize the answer books by following "double valuation". Then the finalized mark is converted to the Letter Grades to be awarded to the students for different courses.
- 2. Three copies of the Grade Sheets containing the marks awarded with Letter Grades and the results in terms of pass or incompletion for each course shall be forwarded to the concerned department.

### XI. Grade Card:

The grade card issued at the end of each semester to each student by the Controller of Examinations office shall contain the following:

- 1. The credits for each course registered for that semester.
- 2. The performance in each course shown by the letter grade obtained.
- 3. The Grade Point Average (GPA) of all the courses registered for the semester.
- 4. The Semester Grade Point Average (SGPA) of all the courses studied from the first semester.
- 5. The maximum marks that can be obtained will be in direct proportion to the credit in the ratio of 25:1.
- 6. The total marks secured by the candidate for each of the courses in which the candidate appeared for the end semester examinations.
- 7. For the computation of cumulative grade point average (CGPA) a similar

formula is used in which the sum is obtained by adding over all the courses taken in all the semesters completed up to the point in time and substituted in the formula used in the case of CGPA.

8. For both GPA and CGPA calculation, NA-Grade is also included but not I-Grade.

### XII. Eligibility for the award of the Undergraduate Degree:

A student shall be declared to be eligible for the award of the Degree diploma, when he/she has fulfilled the following conditions.

- 1. Registered for and undergone all the core/elective and supportive courses and completed the Project Work or field trip, etc if any as prescribed by the Scheme of Examinations.
- 2. Successfully acquired the required credits under elective and supportive courses as specified in the curriculum of the Programme within the stipulated time.
- 3. Has a CGPA of 4.0 or higher.
- 4. Have no dues to the Deemed to be University, Hostel and Library.
- 5. Has no disciplinary action pending against him/her.
- 6. Classification of the student for awarding the degree will be as follows:

SI. No.	СGРА	Grade Point	Classification
а	8-10	10 9	First class with distinction
b	6-8	8 7	First class
с	4 -6	6 5	Second class

### XIII. Procedure for redressal on the award mark:

The Controller of Examinations office is involved in valuation of answer scripts of various courses conducted as the end semester examination (75 marks). The answer scripts of different courses are subjected to two valuations. They are called as first and second valuation. Whenever the difference in marks between first and

second valuation is within 20% marks, the average of the two marks will be taken as the mark secured and the results are declared by the COE. If the difference in mark is 20% and above, it will be referred to a third examiner and the third valuation will be compared with the nearest two other marks in arriving at the average mark.

- When a student is aggrieved with regard to the award of mark to course(s), he/she shall make a formal representation on the matter to the Controller of Examinations through the HOD in the prescribed form and fees within the stipulated time.
- 2. At Controller of Examinations office, the marks awarded for each answer will be re-totaled by a competent authority. The result of the re-totaled will be intimated to the candidate and HOD within 15 days.

### XIV. (a) Details of Sessional Assessment / Internal Assessment for Language part I and II, Core, Allied ,Skill based, Elective papers (For 25 Marks)

Examinations	Assessment	Marks	
Test	Average of best two test performance	10	
Assignment	Average of the two submitted	05	
Seminar	Average of best two Presentation of a topic	05	
Attendance	65-75% of attendance / semester 75-85% of attendance 85-90% of attendance 90-95% of attendance 95-100% of attendance	1 mark 2 marks 3 marks 4 marks 5 marks	05

(b) Details of Sessional Assessment / Internal Assessment for compulsory papers (For 20 Marks)

Examinations Assessment		Marks
Test	Average of best two test performance	10
Assignment	Average of the two submitted	05
Seminar	Average of best two Presentation of a given topic	05

The question paper for the test, topic of the assignments and seminar will be assigned by the respective course teacher. All tests will be conducted only on prior notice in the respective departments. The exact date and timing will be announced by the HOD at the start of the semester.

### XV. Question Paper Pattern (Language part I and II, Core, Skill based, Elective)

Time : 3 Hours	Maximum Marks:75
	Brief note
PART A : (5 X 2 =10 marks) Answer ALL questions All questions carry equal marks	1. Unit I 2. Unit II 3. Unit III 4. Unit IV
	5. Unit V

Short answers	Essay type
6. a or b Unit I	11.Unit I
7. a or b Unit II	12.Unit II
8. a or b Unit III	13.Unit III
9. a or b Unit IV	14.Unit IV
10. a or b Unit V	15. Unit V
PART B: (5 X 4 = 20 marks)	PART C : (15 X 3 = 45 Marks)
Answer ALL questions choosing either a or b	Answer any THREE questions
All questions carry equal mark	All questions carry equal marks

## XVI. Question Paper Pattern (Allied)

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Maximum Marks:50

	Brief note
DADT A · / E V 1 - DE marke)	1. Unit I
PARIA : (J A 1= UJ IIIdIKS)	2. Unit II
Allswer ALL questions	3. Unit III
All questions carry equal marks	4. Unit IV
	5. Unit V
	Short answers
DADT B: /E V 2 - 1E mar/c)	6. a or b Unit I
ran b. (J A J = 1J IIIal Ks) Anomor Al Fernorchione choocing of their a or h	7. a or b Unit II
אוואשרו אבר קעפטנוטוט טווטטאוווט פונוופו מ טו ט אוו מייהר <del>ו</del> נהמה המהיל ממיוהן מממלי	8. a or b Unit III
All duestions cally equal IIIal K	9. a or b Unit IV
	10. a or b Unit V
	Essay type
BABT C . /2 V10 - 20 Marla)	11.Unit I
PARI C. (J AIU = JU Marks)	12.Unit II
	13.Unit III
All questions cally equal IIIal ks	14.Unit IV
	15. Unit V

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# XVII. Question Paper Pattern (Compulsory paper)

Time: 1 Hour	Maximum Marks:30
PART A : (5 X 1=05 marks)	Brief note
All questions carry equal marks	
PART B: $(5 \times 2 = 10 \text{ marks})$	
Answer ALL questions choosing either a or b	SIIUL dIISWEIS
All guestions carry equal mark	

Eccay type	רששט יאףכ	
PART C : (3X 5=15 Marks)	Answer any THREE questions	All questions carry equal marks

			Total Credit	4	4	4	4	S		2	21														
SEMESTER I	be University Examination	be University Examination	ersity Examination	Max. Marks	100	100	100	100	75		50	525													
				ersity Exami	ersity Exami	ersity Exami	ersity Exami	ersity Exami	ersity Exami	ersity Exami	ersity Exam	versity Exam	iversity Exan	versity Exam	<b>rersity Exam</b>	rersity Exam	iversity Exam	Theory/ Practical Exam	75	75	75	75	50		30
			IA	25	25	25	25	25		20															
	Deemed to	Duration CI in Hours CI	e	ſ	3	ſ	c		2																
	Hrs/ week CIA		6	6	4	4	e	3	2																
			Paper Duration in Hours	English I	English I/Kannada I	Introduction to Environ- mental Sciences		Basics of Biostatistics		Environmental Studies															
		Study Components	Part I	Part II	Core Paper I	Core Practical I	Allied I	Allied Practical I	Environmental Stud- ies																
		Part St		I	II	III				IV															

### BSc Environmental Sciences Examination Scheme

		SE	MESTER II			
Ι	Part I	English II	6	3	25	7!
II	Part II	English II/Kannada II	6	3	25	7!
III	Core paper II	Ecosystem Dynamics	4	3	25	7!
	Core Practical II		4	3	25	7!
	Allied II	Principle of Biochemistry	3	3	25	5
	Allied Practical I & II		3	3	20	3(
		SE	MESTER III			
Ι	Part I	English III	6	3	25	7
II	Part II	English III/Kannada III	6	3	25	7!
III	Core Paper III	Components of Biodiversi- ty and Conservation	4	3	25	7!
	Core Paper IV	Natural Resources	4	3	25	7!
	Core Practical III		4	3	25	7

			Allied III		Bioi	nformatics	3	3	25	50
			Allied Pra III	ctical			3			
	IV		Skill base	d I	Basi	ics of Computers	3	3	25	7
					SE	MESTER IV				
	T		Part I		Ena	lish IV	6	3	25	7!
	II		Part II		Eng	lish IV/Kannada IV	6	3	25	7!
	III		Core Pape	er V	Envi oqy	ironmental Microbiol-	4	3	25	7!
			Core Prac	tical			4	3	25	7!
	100	4			Fun	damentals of Nano-	2	2	25	
	100	4	Allied IV		tech	nology	3	3	25	51
	100	4	Allied Pra	ctical	Eup	damontals of Nano				
	100	4			tech	nology/ normatics	3	3	20	30
75 3				DIOI						
	IV		Skill base	d II	Tiss	ue Culture	3	3	25	7!
	50	2								
	SEM	IESTER	V							
	<b>⇒</b> <u>4</u> <u></u> ∍	21	Core pape	er VI	Env	ironmental Chemistry	4	3	25	7
	100	4	Core pape VII	er	Env	ironmental Pollution	4	3	25	7
	100	4	Core Pape	er	Environmental Monitoring and Techniques al		4	3	25	7
	100	4	Core Prac	tical			4	3	25	7!
	100	4	Flective I				4	3	25	+ 7
	100	4	Skill base	d	Δdv	anced Instrumentation				+
	IV		subject II	II Techniques		niques	3	3	25	7!
										+
	SEM	IESTER	VI				1	I	1	
	III			Core per IX	Pa- X	Environmental Man- agement	4	3	25	7!
				Core per X	Pa-	Eco-restoration and Development	4	3	25	7
				Core pract VI	ical		4	3	25	7!
				Electi II	ve		4	3	25	7!
				Electi III	ve		4	3	25	7!

Total (Semester I to VI)					
V Sio tivi	iten- on ac- vities				

### **BSc Environmental Sciences**

50	2	

### **Course Overview**

The prudent management of our precious water resources, environment conser-**3599**n, **1440** sustainable development are high on the agenda of global concerns. Addressing these challenges requires professionals with a high degree of specialization and interdisciplinary approach. In order to develop improved systems and practices to preserve the most precious resource of our planet, there are a great demand fort rained people. In view of the huge focus and investment made by all nations on the water sector, there is a tremendous need for specially trained manpower for supporting the institution involved in the development and management of water, at both the grass roots levels and at the institutional level. Applying knowledge gained through environmental science is the only way to solve these problems so that the environment can be preserved. The rapid urbanization of the environment needs to be studied constantly in order to avoid altering and damaging the environment significantly. Ultimately, environmental science is necessary to save the environment from destruction and all of its dependents from extinction. M.Sc., environmental science at JSS AHER is intended for professional's practitioners, researchers and students from wide range of backgrounds who aim to develop their knowledge and insights pertaining to the environment. The course in designed to provide critical and practical skills to analyses, evaluate, design and implement solution and strategies with regards to water and health issues.

### Syllabus

### PART I. ENGLISH I

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I.** Passages 1 to 5.

**Unit II. 2**: Correct Use of Nouns and Correct Use of Pronouns

Unit III. Correct Use of Adjectives and Correct use of the Verb

**Unit IV**. Roots (A to F)

**Unit V**. Roots (G to N)

### PART II. ENGLISH I

**Unit I**. Passages 1 to 5

**Unit II**. Poems: "When in Disgrace" by Shakespeare; "Daffodils" by William Wordsworth; "Obituary" by A K Ramanujan

**Unit III.** Prose: The Ultimate Safari" by Nadine Gordimer and "The Gift of the Magi" by O 'Henry

**Unit IV.** Poems: "Because I Could Not Stop for Death" by Emily Dickenson; "After Apple Picking" by Robert Frost and "Sonnet – The Lotus" by Toru Dutt.

**Unit V.** Prose: "The Face on the Wall" by E V Lucas and "Kabuliwala" by Rabindranath Tagore

### ಮೊದಲನೇ ಸೆಮಿಸ್ಟರ್

### ಪತ್ರಿಕೆ- 1: ಸವಿಸ್ತರ -ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 1

ಭಾಗ – 1						
ಪದ್ಯಗಳ ಓದು ಮತ್ತು ವ್ಯಾಖ್ಯಾನ						
1.	ಕನ್ನಡಿಗರ ತಾಯಿ	:	ಗೋವಿಂದ ಪೈ			
2.	ಕಾಣಿಕೆ	:	ಬಿ.ಎಂ.ಶ್ರೀಕಂಠಯ್ಯ			
3.	ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ	:	ಕುವೆಂಪು			
4.	ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ	:	ದ.ರಾ.ಬೇಂದ್ರೆ			
5.	ರಂಗವಲ್ಲಿ	:	ಮ.ತಿ.ನರಸಿಂಹಾಚಾರ್			
6.	ಸಂಬಳದ ಸಂಜೆ	:	ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ			
7.	ಯಾವ ಹಾಡ ಹಾಡಲಿ	:	ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ			
8.	ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ	:	ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ			
9.	ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ	:	ನಿಸಾರ್ ಅಹಮದ್			
10.	ಅನಾಥೆ	:	ಸುಕನ್ಯಾ ಮಾರುತಿ			
11.	ನೀವೆಲ್ಲಿಯವರೋ	:	ಜಂಬಣ್ಣ ಅಮರಚಿಂತ			
12.	ಯುದ್ಧ	:	ಸವಿತಾ ನಾಗಭೂಷಣ			

### ಭಾಗ – 2

ಗದ್ಯ	ಭಾಗ – ಪ್ರಬಂಧಗಳು		
1.	ಗರುಡಗಂಬದ ದಾಸಯ್ಯ	:	ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
2.	ದೇವರು ಮತ್ತು ಪುನರ್ಜನ್ಮ	:	ಎಚ್.ನರಸಿಂಹಯ್ಯ ದೆ
3.	ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ	:	ಪಿ.ಲಂಕೇಶ್
4.	ಮೊಬೈಲ್ ಠೇಂಕಾರದ ಜೇನ್ನೊಣಗಳ ಝೇಂಕಾರ	:	ನಾಗೇಶ್ ಹೆಗಡೆ
5.	ಆಗಸ್ಸ್–6 – ಶಾಂತಿದಿನ – ಶ್ರೇತಭವದನದ	:	ನೇಮಿಚಂದ್ರ
	– ಮುಂದೆ 20 ವರ್ಷ		-

### ಭಾಗ – 3

ಆಡಳಿತ ಕನ್ನಡ

- edve ಭಾಷೆಯಾಗಿ ಕನ್ನಡ, ಸ್ವರೂಪ, ಲಕ್ಷಣ
   ಆಡಳಿತ ಕನ್ನಡ ಬೆಳೆದು ಬಂದ ದಾರಿ (ಆಡಳಿತ ಕನ್ನಡದ ಇತಿಹಾಸ)

### ಭಾಗ – 4

ಆಡಳಿತ ಕನ್ನಡ – ಪ್ರಾಯೋಗಿಕ ಬರವಣಿಗೆ

1. ಸರ್ಕಾರಿ ಪತ್ರದ ವಿವಿಧ ಅಂಗಗಳು – ಮಾದರಿಯೊಡನೆ

- 2. ವಿವಿಧ ಸರ್ಕಾರಿ ಪತ್ರಗಳು

  - ಅಧಿಕೃತ
    ಅರೆ ಅಧಿಕೃತ
    ಅಧಿಕೃತ ಜ್ಞಾಪನ
    ಸುತ್ತೋಲೆ

ಭಾಗ – 5 ಪದ್ಯಗಳ ಮರುವ್ಯಾಖ್ಯಾನ ಮತ್ತು ವಿಮರ್ಶಾತ್ಮಕ ಚರ್ಚೆಗಳು

### CORE PAPER I

### INTRODUCTION TO ENVIRONMENTAL SCIENCES 4 Credits

**Outcome:** This course introduces the students to the interdisciplinary nature of environmental sciences. The students learn about rock types, basic concepts of community, pollution and biodiversity.

**Outcomes:** The students are able to appreciate the intricate nature of ecosystem and its role in maintenance of health earth.

**Unit I:** Definition, scope, interdisciplinary nature of environmental science, types, components of environment (atmosphere, hydrosphere, lithosphere and biosphere). Concept of environmental education, history of environmental education and its goals, need, objectives. Awareness methods and people and environment.

**Unit II:** Rock types and formation, the rock cycle. Soil formation process, soil types and its status, physical, chemical and biological characters of soil, soil profile and concept of soil erosion.

**Unit III:** Basic concepts, characteristics of population – density, natality, mortality, age-structure, dispersion and movement. Causes for population explosion, population growth and population regulation. Intraspecific and interspecific interactions among population – competition, predation, parasitism, mutualism and commensalism.

**Unit IV:** Basic concepts of community, life form, stratification, methods of plant community analysis, Ecotone, edge effect, ecological niche, keystone species and ecological succession.

**Unit V:** Pollution, energy resources, biodiversity loss, hotspots, acid rain, ozone layer depletion, greenhouse effect and climate change. *Concerns:* Chipko movement, Biodiversity conservation, Project Tiger, Kyoto protocol and role of individual in conservation of energy.

### **Reference Books:**

- 1. Thomas M. Smith and Robert L. Smith (2012), Elements of Ecology (8th Edn), Pearson Benjamin Cummings,
- 2. George L Clarck 2014, Elements of Ecology, John Wiley & Son Inc. Newyork
- 3. Charles Krebs (2013), Ecology: Pearson New International Edition (6th Edin),
- 4. Michael Begon, Colin R. Townsend and John L. Harper (2016), Ecology: From Individuals to Ecosystems (4th Edition), John Wiley & Sons, New Jerssy.
- 5. Eugene P. Odum and Gary W. Barrett (2014), Fundamentals of Ecology (5th edn), brooks/cole, US
- 6. Krebs, Charles J (2011), Ecology: The Experimental Analysis of Distribution and Abundance (6th Edn), Benjamin-Cummings Publishing Company
- 7. Muller-Dombols, D. and Ellenberg, H. (2014). Aims and Methods of Vegetation Ecology, Wiley, New York.

### CORE PRACTICAL I 4 Credits

- 1. Introductory Laboratory Techniques
- 2. Determination of requisite size of the quadrant for vegetation analysis.
- 3. Analysis of frequency distribution of plants in a piece of vegetation by quadrat method.
- 4. Grain Size Analysis.
- 5. Study of soil profile
- 6. Quantitative analysis of soil pH.
- 7. Quantitative analysis of soil conductivity.
- 8. To study pore space and water holding capacity of soil.
- 9. To study bulk density of soil.

10.Quantitative analysis of soil organic carbon.

### ALLIED PAPER I BASICS OF BIOSTATISTICS 3 Credits

**Objectives:** This course imparts the knowledge of basic statistical methods to solve problems. Students are taught to operate various statistical software packages

**Outcomes:** The students are able to appreciate the importance of statistics in research and prepare them for a career in research

**Unit I: Introduction to Statistics:** Definition and Application Of Statistics, Qualitative Data, Quantitative Data, Frequency Distribution, Cumulative Frequency, Diagrammatical Representation Of Statistical Data(Bar, Pie), Graphical Representation Of Frequency Distribution (Histogram, Frequency Polygon, Cumulative Frequency Curves).

**Unit II: Descriptive Statistics:** Measure of Central Tendency: Mean, Median, Mode, Geometric Mean (Merits and Demerits), Measure of Dispersion: Range, Standard Deviation, Variance, (Merits and Demerits), Co-Efficient of Variation.

**Unit III. Probability:** Trial, event, sure event, random event, Sample space, Definition of probability, mutually exclusive events, Independent event, Law's of Probability - simple problems, Normal probability curve.

**Unit IV: Hypothesis Testing:** Hypothesis, Types of Hypothesis, Level Of Significance, Type I and Type II Error, Standard Error, Degrees Of Freedom, Chi Square Test, Student's t Test: One Sample t Test, Paired t Test.

**Unit V: Correlation and Regression: Correlation:** Definition, Types Of Correlation, Karl Pearson's Coefficient Of Correlation, Simple Linear Regression, One Way ANOVA.

### **Reference Books:**

- 1. Fundamentals of Mathematical Statistics (2015) S.C. Gupta and V. K. Kapoor
- 2. Fundamentals of Statistics (2011): S.C. Gupta
- 3. Fundamentals of Biostatistics (2014): Veer Bala Rastogi

### COMPULSORY PAPER ENVIRONMENTAL STUDIES 2 Credits

**Objective:** The main objective of this paper is to create awareness among the students about the environment

**Outcome:** The students will have a better appreciation for the environment and become responsible citizens

**Unit I:** The Multidisciplinary nature of environmental studies: Natural Resources. Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit II:** Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit III:** Environmental Pollution: Air pollution; Water pollution; Soil pollution

### **Reference Books:**

- 1. Y.K. Sing: Environmental Science, New Age International Pvt, Publishers, Bangalore. 2011
- 2. Agarwal, K.C. 2011 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- 3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad. India,
- 4. Brunner R.C., 2015, Hazardous Waste Incineration, McGraw Hill Inc. 2015
- 5. Clark R.S., Marine Pollution, Clanderson Press Oxford 2015
- 6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2011, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2015
- 7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 2011
- 8. Down of Earth, Centre for Science and Environment 2011

### SEMESTER II

### PAPER I ENGLISH II

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

Unit I. Passages 1 to 4

**Unit II:** Grammar - Correct Use of Adverbs; Correct use of Prepositions; Reported Speech

**Unit III:** Roots (O to T); Prefixes; Suffixes

**Unit IV:** Grammar - 1. Correct Use of Conjunctions; 2. Correct use of Articles; 3. Parallelism

Unit V: Roots (U to Z ); New Words in English

### PART II ENGLISH II

**Unit I**: Passages 1 to 5

**Unit II**: Poems: "The Frog and The Nightingale" by Vikram Seth and "Ozymandias" by P.B Shelly

**Unit III:** Prose - 1. "Such Perfection" By R.K Narayan and 2. "Retrieved Reformation" by O" Henry

**Unit IV:** Poems; "Wild Swans at Coole" by W.B Yeats; "Lucy Grey" by William Wordsworth; "Stopping by Woods on a Snowy Evening" by Robert Frost

**Unit V:** Prose: "His Wedded Wife" by Rudyard Kipling and "The Merchant of Venice" (trial scene) by Shakespeare

ಎರಡನೇ ಸೆಮಿಸ್ಟರ್

ಪತ್ರಿಕೆ – 2 : ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 2 ಭಾಗ – 1 ಸವಿಸ್ತರ ಪಠ್ಯ 1. ನಾಟಕ – 1 ಕಾಕನಕೋಟೆ – ಮಾಸ್ತಿ ವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್ ಭಾಗ – 2 ಅವಿಸ್ತರ ಪಠ್ಯ 1. ಕಾದಂಬರಿ/ವೈಚಾರಿಕ ಬರಹ ಒಡಲಾಳ – ದೇವನೂರು ಮಹಾದೇವ ಭಾಗ- 3 ಆಡಳಿತ ಕನ್ನಡ – 2 1. ಅರ್ಜಿ : ಸ್ವರೂಪ ಮತ್ತು ವಿವಿಧ ಬಗೆಗಳು ಕಡತ (ಫೈಲು) 2. 3. ಕಚೇರಿ ಕಾರ್ಯವಿಧಾನ ಮತ್ತು ಕಚೇರಿ ಟಿಪ್ಪಣಿಗಳು ಸರ್ಕಾರಿ ಪ್ರಕಟಣೆ, ಜಾಹೀರಾತು (ಸ್ತರೂಪ–ರಚನೆ) 4. ಭಾಗ– 4 ಸವಿಸ್ತರ ಪಠ್ಯ ಕಾಕನಕೋಟೆ ನಾಟಕದಲ್ಲಿನ ಪಾತ್ರಗಳು, ಘಟನೆಗಳ ಸ್ರಾರಸ್ಯ ವಿವರಣೆ ಮತ್ತು ವಿಶ್ಲೇಷಣೆ ಬಾಗ – 5 ನಾಟಕ ಮತ್ತು ಕಾದಂಬರಿಗಳ ಕುರಿತು ವಿಮರ್ಶೆ ಮತ್ತು ಚರ್ಚಾತ್ಮಕ ವಿಶ್ಲೇಷಣೆ

### CORE PAPER II

### ECOSYSTEM DYNAMICS 4 Credits

**Objectives:** This introductory course introduces the students to the basic concepts in ecosystem dynamics. The students learn about ecology, biogeochemical cycles, evolution and biomes.

**Outcomes:** At the end of the course, the students have a clear understanding on the importance of ecosystem

**Unit I:** Ecosystem: Basic concepts, structure of ecosystem, Abiotic and Biotic components, food chains and food webs, Trophic levels, Ecological pyramids.

**Unit II:** Function of ecology- material and Energy flow in ecological systems, energy efficiencies, Concept ecological pathways, conservation of matter.

**Unit III:** Significance of biogeochemical Cycles: gaseous and sedimentary cycles. Oxygen, Carbon, Nitrogen, Phosphorus and Sulphur Cycles, Hydrological cycles.

**Unit IV:** Evolution and Succession: Concepts of succession, succession process- 'r' and 'k' hypothesis, Types of Succession. Clements' theory of succession, Climax and stability, seral community, Co-evolution and group selection, Forest succession.

**Unit V:** Biomes and classification, Characteristics of major biomes-terrestrial fresh water and marine ecosystems, important terrestrial and aquatic ecosystems of India, Major biomes of the world.

### **Reference Books:**

- 1. W. S. C. Gurney, R. M. Nisbet (2014), Ecological Dynamics, oxford university press.
- 2. Odum, E.P. (2015), Basic Ecology, Sanders, Philadelphia.
- 3. Robert Ricklefs (2011). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
- 4. Singh K.P. and J.S. Singh (2014). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
- 5. Singh, J.S. (ed.) 2014. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
- 6. Smith, R.L. (2016). Ecology and Field Biology, Harper Collins, New York.
- 7. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.

### CORE PRACTICAL-II 4 Credits

- 1. Sampling techniques.
- 2. Quantitative analysis of water conductivity and pH
- 3. Determination of turbidity of a given sample
- 4. Quantitative analysis of water alkalinity
- 5. Quantitative analysis of water acidity
- 6. Quantitative analysis of water hardness
- 7. Quantitative analysis of water chloride
- 8. Demonstration of water conservation techniques.
- 9. Field Ecology Terrestrial and aquatic flora

10.To prepare a report on various types of local fresh water ecosystem.

### Allied Paper II Principles of Biochemistry 3 Credits

**Objectives:** The course aims to provide exposure to the students regarding the importance of biological macromolecules and their role in reactivity of biomolecules

**Outcomes:** At the end of the course, the students have a thorough understanding on the role of biomolecules and their functions. Being an allied paper it ensures to create enough relevance with role of biomolecules in life to all disciplines like biotechnology, microbiology, food, nutrition and dietetics; as well as environmental sciences.

**Unit I:** Introduction of Cells, Water, Thermodynamics, Bonds, Photosynthesis and Respiration.

**Unit II:** Carbohydrates-Classification, Metabolism: Glycolysis, Gluconeogenesis, Krebs Cycle, Pentose Phosphate Pathway, Glyoxylate cycle. Electron Transport Chain, ATP Synthesis.

**Unit III:** Classification of Amino Acids. Peptide bond, Peptides, Protein structure, Enzymes action and classification. Nitrogen cycle. Amino acid metabolism and degradation.

**Unit IV:** Classification of lipids, Fatty acid oxidation and synthesis, Lipid bilayer, Lipid transport. Ketone bodies.

**Unit V:** Nucleic acids: Types of DNA and RNA, Central dogma of Molecular Biology, Replication, Transcription and Translation.

### **Reference Books:**

- 1. Nelson, D. L. & Cox, M. M. Lehninger, 2013, Principles of Biochemistry. Freeman - 6th edition,
- 2. U Satyanarayana, 2013, Biochemistry. Elsevier. 5th Edition.
- 3. Berg, J. M., Tymoczko, J. L. and Stryer, L. 2011, Biochemistry. Freeman -7th edition.
- 4. Voet, D., Voet, J. G., & Pratt, C. W. 2011. Fundamentals of Biochemis-

try (pp. 408-409). New York: Wiley – 4th edition.

- 5. Conn, E., &Stumpf, P. 2016. Outlines of Biochemistry. John Wiley & Sons 5th edition.
- 6. West, E. S., Todd, W. R., Mascon, H. S., & Van Bruggen, J. T. 2014. Textbook of Biochemistry. Oxford and IBH Publishing - 4th Edition
- 7. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J. 2013. Molecular Cell Biology, Freeman 7th edition.

### SEMESTER III PART I ENGLISH III

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Passages 1 to 5

**Unit II**: Grammar; Active and Passive Voice and Modal Auxiliaries

**Unit III**: Vocabulary; Homonyms; Figures of Speech: Alliteration, Metaphor and Simile

**Unit IV**: Grammar: Foreign expressions and Phrasal Verbs

**Unit V**: Vocabulary - Figures Of Speech: Antithesis, Hyperbole, Euphemism, Iro

### PART II ENGLISH III

Unit I. Passages 1 to 5

**Unit II.** Poetry: "On His Blindness" by John Milton; "Solitary Reaper" by William Wordsworth; "The Road Not Taken" by Robert Frost

**Unit III.** Prose: "The Sniper" by Liam O' Flaherty and "A Hero" by R K Narayan

**Unit IV**: Poetry: "Where The Mind is Without Fear" by Rabindranath Tagore; "Ode To Autumn" by John Keats; "Lord Ullin's Daughter" by Thomas Campbell

**Unit V.** Prose: "The Open Window" by Saki and "The Bishop's Candlesticks" by Victor Hugo

### ಪತ್ರಿಕೆ– 3 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 2

ಭಾಗ – 1

- ನಿಗಧಿತ ಭಾಗಗಳು: (ನಿಗಧಿತ ಪದ್ಯಗಳು ಮತ್ತು ಕಥಾಭಾಗ)
- ಪಂಪನ ವಿಕ್ರಮಾರ್ಜುನ ವಿಜಯ: ದ್ವಾದಶಾಶ್ವಾಸಂ ಮಾನಸರೇನಿನ್ನೂಲು ವರ್ಷಮಂ ಬಲ್ಧಪರೇ
- 2. ಜನ್ನನ ಯಶೋಧರ ಚರಿತೆ ಮಾಡಿದುದಂ ನಾವುಣ್ಣದೆ ಪೋಕುಮೆ

### ಭಾಗ – 2

- 1. ನಿಗದಿತ ಹತ್ತು ವಚನಗಳು ಬಸವಣ್ಣ । ಅಲ್ಲಮಪ್ರಭು । ಅಕ್ಕಮಹಾದೇವಿ । ಅಂಬಿಗರ ಚೌಡಯ್ಯ ಅಮುಗೆ ರಾಯಮ್ಮ
- ಗೀತೆಗಳು : ಸಂಗ್ರಾಹಕ ಸಂಪಾದಕ : ಮತ್ತಿಘಟ್ಟ ಕೃಷ್ಣಮೂರ್ತಿ ಜನಪದ ಗೀತೆ : ಮುಕ್ಕಣ್ಣ ಮಳೆಯ ಕರುಣಿಸು
- ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ : ಅರಣ್ಯಪರ್ವ ಸೌಗಂಧಿಕದ ಪವನನ ಬಳಿವಿಡಿದು

### ಭಾಗ – 3

ಅವಿಸ್ತರ ಪಠ್ಯ

ಸಮಾಜಸುಧಾರಕ ಮಹಾತ್ಮಪುಲೆ (ಮೂಲ ಮರಾಠಿ ಕರ್ತೃ : ಮುರಳೀಧರ ಜಗತಾಪ) ಕನ್ನಡಕ್ಕೆ ಅನುವಾದಕರು : ಅಕಿಂಚನ – ನವಕರ್ನಾಟಕ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು.

### ಭಾಗ – 4

- 1. ಕನ್ನಡ ಪದಕೋಶದ ಬೆಳವಣಿಗೆ
- 2. ದೇಸಿ, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು ಮತ್ತು ಪಾರಿಭಾಷಿಕ ಪದಗಳು
- 3. ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಸಂಪಾದಕರಿಗೆ ಪತ್ರ
- 4. ವರದಿ

### ಭಾಗ – 5

- 1. ಪ್ರಾಚೀನ ಹಾಗೂ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಸಾಂಸ್ಕೃತಿಕ, ಸಾಮಾಜಿಕ ಮತ್ತು ರಾಜಕೀಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಪಠ್ಯದ ವಿಮರ್ಶೆ
- 2. ಜೀವನ ಚರಿತ್ರೆಯ ಸ್ವರೂಪ ಲಕ್ಷಣ ಹಾಗೂ ನಿಗಧಿತ ಪಠ್ಯದ ಅವಲೋಕನ.

### CORE PAPER III

### COMPONENTS OF BIODIVERSITY & CONSERVATION 4 Credits

**Objectives:** The aim of this course is to impart the knowledge of biodiversity and conservation of environmental resources. The students study the taxonomic nomenclature, global biodiversity, endangered species and approaches in their conservation.

**Outcomes:** At the end of the course, the students have a thorough understanding on the components in biodiversity and the methodology in conservations.

**Unit I:** Biodiversity: Basic concepts, importance and conservation need, Species diversity, Biological and phylogenetic species concept, speciation, natural longevity of species and optimum biodiversity, species extinction.

**Unit II:** Classification, taxonomic nomenclature, Principles of classification and nomenclature of plants, animals and micro-organism, General Characteristics, habitat and economic importance of microorganism-Chemoautotrophs, Bacteria, Blue-Green Algae, Yeasts, Fungi and Algae, Microbial toxins in environment, Microbial Diseases of man

**Unit III:** Diversity of insects, nematodes, fishes, birds, reptile and other mammals, their role in environment and economic, food, fisheries, pollination and seed dispersal, importance of wild life, endangered species, Bryophytes and lichen, land habit in Bryophytes, role of bryophytes in soil building. Lichens as ecological indicators, Pteridophytes, gymnosperms and angiosperms, general characteristics, habitat, role in environment and economic uses.

**Unit IV:** Global Biodiversity Conservation: Endemism and hotspots, The Critical Role of Hotspots, Biological diversity, degeneration of biological diversity-invertebrates, Biological diversity and future climate, Factors for decline of biological diversity, Approaches for conservation of biological diversity, Protection of wild flora, fauna and natural habitats,

**Unit V:** Concept of threatened species, Threatened and endangered animals of India, Importance and conservation of tropical regions, wetlands, mangroves, coral reefs, Ex-situ and In-situ conservation, Wild life sanctuaries, National Parks and Biosphere Reserve, Concept of genetic diversity, gene and germ-plasma banks, Biodiversity convention, Socio-cultural aspects of biodiversity, Biotechnological needs for biodiversity conservation, Traditional knowledge and biodiversity conservation.

### **Reference Books:**

- 1. Chandel, K.P.S., Shukla, G. And Sharma, N. (2014). Biodiversity in Medicinal and Aromatic Plants in India Conservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
- 2. Zachos, Frank E.; Habel, Jan Christian (2011) Biodiversity Hotspots, Distribution and Protection of Conservation Priority Areas, Springer
- 3. Council of Scientific and Industrial Research (2017). The Useful Plants of India Publication and Information Directorate, CSIR, New Delhi.
- 4. Nair, M.N.B. (2014). Sustainable Management of Non-wood Forest Prod-

ucts. Faculty of Forestry, University Putra. Malaysia. 434 004 PM Serdong, Selangor, Malaysia.

5. Soule, M.E. (ed.) (2014). Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.

### CORE PAPER IV NATURAL RESOURCES 4 Credits

**Objectives:** In this course, the students study about the various types of natural resources. The course also covers aspects of renewable energy resources, biological resources, water resources and sustainable development.

**Outcomes:** At the end of the course, the students have a clear understanding on the various natural resources and methodology in the effective management.

**Unit I:** Basic concepts, role in human civilization, World energy scenario, Renewable and nonrenewable sources of energy. Non-Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects. Energy utilization and its effects on environment, Energy crisis

**Unit II:** Renewable Energy Resources: Hydropower, Solar energy, geothermal, tidal and wind energy, Energy conservation: In agriculture and industrial sector, Energy plantation; Petro crops, Hydrogen as a future energy source, waste to energy concept, Sustainable use of energy resources, Biotechnological approach of Energy management- Biomass, biogas, bioethanol, bio-hydrogen, advantages

**Unit III:** Biological resources: Types and uses of biological resources, Forest resources and conservation in India, Wild life conservation efforts in India, Project tiger, range management, soil and Mineral resources: mineral resources in India, types of soil, soil erosion. Soil conservation techniques. Types of land use, Land conservation strategies

**Unit IV:** Water resources: Types and uses of water resources, Methods of enhancing fresh water supply, Watershed management & its importance, Sustainable management of water resources in agriculture, industry and urbanization, Remote sensing in resource management

**Unit V:** Concept of sustainable development and management of natural resources, Environment awareness and education, major conservation effort of National Agency- MoFE and CPCB, introduction to major international agency – WWF, IUCN, UNEP, CITES, ENVIS

### **Reference Books:**

- 1. Singh, J.S., Singh, S.P. and Gupta, S.R. 2016. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
- 2. Donahue R.L. and Miller R.W. 2014. Soils in Our Environment, Prentice Hall of India Pvt. Ltd., New Delhi.
- 3. Morgen, M.D. Morgen J.M. and Wiersima J.H. 2014, Environmental Science: Managing Physical and Biological Resources Wm C Brown Publishers London.
- 4. Tyler Miller Jr. G. 2015. Living in the Environment. Wadsworth Publishing
Company, Belmont California.

- 5. Botkin, D.B and Keller E.A., 2015, Environmental Studies: The earth as a living plant. Charles E. Merrill, Publishing Co. London.
- 6. Shastri M.N. 2014, Energy Options: Himalaya Publishing House, New Delhi.
- 7. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. 2015, Fundamentals of Environmental Science, Kalyani Publishers, New Delhi.
- 8. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

#### CORE PRACTICAL III 4 Credits

- 1. Identification of rocks and minerals on the basis of physical characters
- 2. Determination wind velocity by anemometer.
- 3. Identification of biological specimens and economical important.
- 4. Sterilization techniques
- 5. Identification of fresh water microbes.
- 6. To determine chlorophyll content of the given plant material.
- 7. Quantitative analysis of water Total solids.
- 8. Quantitative analysis of water Nitrate.
- 9. Quantitative analysis of water Sulphate.
- 10.Quantitative analysis of water Fluoride

# ALLIED PAPER III FUNDAMENTALS OF BIOINFORMATICS 2 Credits

**Objectives:** This allied paper introduces the students to concepts in bioinformatics

**Outcomes:** The student will be able to apply basic principles of biology, computer science and mathematics to address complex biological problems

**Unit I:** Introduction and history of bioinformatics–Internet, World Wide Web, Web browser, EMBnet, NCBI. File transfer protocol.

**Unit II:** Database browsers and search engines. Introduction to MS access, making queries, Designing forms, Report design

**Unit III:** Database-Definition, DBMS, Biological Databases– FASTA, Blast, Genbank, DNA sequence data bases, Protein databases.

**Unit IV:** Entry formats, carbohydrate databases, Enzyme databases, Pathway databases. Relational data base model. Theory on RDBMS. SQL.

**Unit V:** Application aspects– gene prediction, target searching's–drug designing – E-cell, phylogenetic analysis, PERL, Chemo-informatics.

- 1. Introduction to Bioinformatics. T.K.Altwood, D.J.Parry-Smith (2014) Pearson Education.
- 2. Bioinformatics for the beginners by K. Mani & N. Vijayaraj (2015). Jaypee

Publishers.

- 3. Proteomics- Pennigton & Dunn (2012). Viva books publishers, New Delhi
- 4. Bioinformatics-A practical guide to the analysis of genes & protein. 2nd Edition. Andreas, Baxevanis and Francis Ouellette.

# SKILL BASED PAPER I

# BASICS OF COMPUTERS 4 Credits

**Objectives:** This is a skill-based paper that introduces the students to the basics of computer operations. The student is imparted with knowledge on both hardware and software.

**Outcomes:** The student has a better understanding on the use of computers for various applications

Unit-I: Fundamentals of Computer, MS- Office, and Operating System

Unit-II: Basics of HTML, HTML 5, J- Query, Database Management System

Unit-III: Basic Networking, VB- Visual Basics, Data Structure using C++

**Unit-IV:** Software Engineering, Asp.net, Computer Graphics.

**Unit-V:** Training on SPSS Software

#### **Reference Books:**

1. Rajib Mall, Fundamentals of Software Engineering (2015), Prentice Hall of India

# **SEMESTER IV**

# PART I ENGLISH IV

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Comprehension Passages and Poems

Unit II: Grammar: Formal Letter Writing and Report Writing

Unit III. Grammar: Story writing. Subject Verb Agreement. Essay writing

**Unit IV**: Vocabulary: Onomatopoeia and Personification

**Unit V**: Vocabulary: Pun, Role Plays and Headline English

# PART II ENGLISH IV

**Unit I**. Poetry: "Mending Wall" by Robert Frost" and "I Know Why a Caged Bird Sings" by Maya Angelou

**Unit II.** Poetry: "Ode to the West Wind" By P. B Shelly, "The Brook" by Alfred Tennyson and "This is going to hurt "by Ogden Nash

Unit: III. Prose - "An Astrologers Day" By R K Narayan and Mahatma Gandhi

**Unit IV**: Prose: "The Refund" by Fritz Karinthy

**Unit V: Prose:** "The Last Leaf" by O 'Henry

#### ಪತ್ರಿಕೆ – 4 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ

ಭಾಗ – 1

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ – 1 : ( 6 ಸುನೀತಗಳು)					
1. ಕವಿತಾವತಾರ	:	ಎಂ. ಗೋವಿಂದಪೈ			
2. ಜೀವ ರೇಶಿಮೆಯ ಹುಳು	:	ಮಾಸ್ತಿ ವೆಂಕಟೇಶ <sup>್</sup> ಅಯ್ಯಂಗಾರ್			
3. ಅಲ್ಲಮಪ್ರಭು	:	ದ.ರಾ.ಬೇಂದ್ರೆ			
4. ವರ್ಡ್ಸ್ವರ್ತ್	:	ಕುವೆಂಪು			
5. ಕವಿ	:	ಪು.ತಿ.ನ			
6. ಕಾಲ್ಚೆಂಡೆ	:	ಈಶ್ವರ ಸಣಕಲ್ಲ			

ಭಾಗ – 2

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ - 2 : ( 6 ಸುನೀತಗಳು)

1.	ಸಣ್ಣಸಂಗತಿ	:	ಕೆ.ಎಸ್.ನ
2.	ತವರ ಮನೆಯಿಂದ ನಾ ನಿನ್ನ ಕರೆಸಿದನೇಕೆ	:	ವಿ.ಜಿ.ಭಟ್ಟ
3.	ಸ್ಥಾವರಕ್ಕಳಿವುಂಟು	:	ಜಿ.ಎಸ್.ಎಸ್
4.	అంతర	:	ಚೆನ್ನವೀರ ಕಣವಿ
5.	ಅನುಭವ ಮಂಟಪ	:	ಜಿ.ಎಸ್.ಸಿದ್ದಲಿಂಗಯ್ಯ
6.	ದೈವ ಕಲಿಸುವ ಪಾಠ	:	ಕೆ.ಎಸ್.ನಿಸಾರ್ ಅಹಮದ್

ಭಾಗ - ಅವಿಸರ	- 3 5 ಪಠ್ಯ– ಗದ್ಯಭಾಗ : ಕಥೆಗಳು		
1. ີ	ಶ್ರಕ್ಷಚಾರ್ಯ	:	ಬಾಗಲೋಡಿ ದೇವರಾಯ
2.	ನಲ್ಲಿಯಲ್ಲಿ ನೀರು ಬಂತು	:	ಕೆ.ಸದಾಶಿವ
3.	ನಿರಾಕರಣೆ	:	ವೀಣಾ ಶಾಂತೇಶ್ವರ
4.	ಬುರ್ಖಾ	:	ಫಕೀರ್ ಮಹಮ್ಮದ್ ಕಟ್ಟಾಡಿ
5.	ಅಲ್ಲಿ ಆ ಅಳು ಈಗಲೂ	:	ಮೊಗಳ್ಳಿ ಗಣೇಶ್

#### ಭಾಗ – 4 ಆಡಳಿತ ಕನ್ನಡ

- 1. ಗಾದೆಯ ಸ್ವರೂಪ, ಬಳಕೆ ಮತ್ತು ವಿಸ್ತರಣೆ
- 2. ವಾಕ್ಯ ರಚನೆ : ಸರಳ ವಾಕ್ಯಗಳು, ಸಂಕೀರ್ಣ ವಾಕ್ಯಗಳು

3. ಪ್ರಬಂಧದ ಸಾಮಾನ್ಯ ಸ್ವರೂಪ, ರಚನೆ

4. ಸಂಕ್ಷೇಪನ ಲೇಖನ ಸ್ವರೂಪ, ಪ್ರಾಯೋಗಿಕ ರಚನೆ

#### ಭಾಗ – 5

1. ನವೋದಯ ಸಾಹಿತ್ಯದ ಕಾಲಘಟ್ಟದಲ್ಲಿ ಸುನೀತ ಪ್ರಕಾರದ ಹುಟ್ಟು ಬೆಳವಣಿಗೆ.

2. ಸುನೀತದ ಲಕ್ಷಣ, ಸ್ವರೂಪಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಾವ್ಯಭಾಗದ ವಿವೇಚನೆ

3. ಧಾರ್ಮಿಕ, ರಾಜಕೀಯ ಹಾಗೂ ಸಾಮಾಜಿಕತೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಥಾಭಾಗದ ವಿಮರ್ಶೆ

#### CORE PAPER V ENVIRONMENTAL MICROBIOLOGY 4 Credits

**Objectives:** This is an interdisciplinary course that focuses on the application of microbiology in environmental remediation. The student in the course study microorganisms, their classification, metabolism, their role in biogeochemical cycles and waste water treatment

**Outcomes:** Through this course, the students will have the basic knowledge in understanding the role of microbes in waste water treatment

Unit I: Fundamentals of Microbiology, Classification of Microorganism, Cell Struc-

ture, Cell Genetic Material, DNA in Prokaryotes and Eukaryotes, Nucleic Acids, Plasmids, Mutations, Genetic Recombinations, Recombinant DNA Technology: Construction of a Genetically Engineered Microorganism (GEM)

**Unit II:** Brief Survey Of Microbial Groups: Bacteria- Size and Shape, Unusual Types of Bacteria (Sheathed Bacteria, Stalked Bacteria, Budding Bacteria, Gliding Bacteria, Bdellovibrio, Actinomycetes, Cyanobacteria) Archaea, Eukaryotes (Fungi)- major groups of fungi- classification of algae, Protozoa, Viruses- Virus Structure, Virus Replication, Detection and Enumeration

**Unit III:** Microbial Metabolism and Growth: Enzymes and Enzyme Kinetics, Effect of Inhibitors on Enzyme Activity, Metabolism: Catabolism, Anabolism, Photosynthesis, Microbial Growth Kinetics: Batch Cultures, Physical and Chemical Factors Affecting Microbial Growth, Measurement of Microbial Biomass

**Unit IV:** Role of Microorganisms in Biogeochemical Cycles: Microbiology of the Nitrogen Cycle, Phosphorus Cycle, Sulfur Cycle, Sulfur Oxidation or Reduction, Water born microbial diseases: Type of Infectious Agent, Waterborne Transmission, Bacterial Pathogens, Opportunistic Bacterial Pathogens, Antibiotic-Resistant Bacteria, Viral Pathogens- Hepatitis, Viral Gastroenteritis, Protozoan Parasites- Giardia, Cryptosporidium, Cyclospora, Entamoeba histolytica, Naegleria

**Unit V:** Microbiology of waste water treatment: Activated sludge processes, Trickling Filters, Waste Stabilization Ponds, Sludge Processing, Pathogen and Parasite Removal during Sludge Treatment, Anaerobic Digestion of Wastewater and Biosolids: Hydrolytic Bacteria, Fermentative Acidogenic Bacteria, Acetogenic Bacteria, Methanogens, Factors Controlling Anaerobic Digestion

# **Reference Books:**

- 1. Gabriel Bitton, Wastewater Microbiology (3rd Edn), 2015, A John Wiley & Sons, Inc., Publication, (ISBN 0-471-65071-4)
- Pelczar, Jr, M.J., Chan, E.C.S., Krieg, R.Noel., and Pelczar Merna Foss, "Microbiology ", 5th Edn., Tata McGraw Hill Publishing Company Limited, New Delhi 2016
- 3. Stainer, R.Y., Ingrahum, J.L., Wheelis, M.C. and Painter, P.R. " General Microbiology ", MacMillan Edn., Ltd., London, 2014.
- 4. Pichai, R. and Govindan, V.S., Edn., "Biological processes in pollution control", Anna University, Madras, 2015.

# CORE PRACTICAL IV 4 Credits

- 1. To prepare a report on various types of local industrial effluents.
- 2. Measurement of sound level using sound level meter.
- 3. Preparation of report on Energy Plantation.
- 4. Demonstration of composting techniques.
- 5. Demonstration of use of solar devices, photo-cells, wind-mills.
- 6. Demonstration of Biogas plant.
- 7. Quantitative analysis of water phosphate.
- 8. Quantitative analysis of Water dissolved oxygen (DO).
- 9. Quantitative analysis of water COD.
- 10.Quantitative analysis of water BOD

#### ALLIED PAPER IV FUNDAMENTAL OF NANOTECHNOLOGY 3 Credits

**Objectives**: This is an interdisciplinary and emerging area. The students are taught the basics of nanotechnology and their applications

**Outcomes**: The course introduces the students to the new and novel applications to solve biomedical problems through nanotechnology

**Unit I: Introduction to Nanotechnology:** Fundamentals of Nanoscience, History of Nanoscience and Nanotechnology, Properties of nanomaterials - optical, electronic and magnetic properties.

**Unit II: Classes of Nanomaterials:** Metal and Semiconductor Nanomaterials, Quantum Dots, Carbon Nanotubes and Bucky balls. Organic based nanomaterials – liposomes, dendrimers, and micelles. Inorganic based nanomaterials – gold/ silver nanoparticles and magnetic nanoparticles

**Unit III:** Synthesis Nanomaterials: Top down method of synthesis - Nanolithography, CVD, ball milling. Bottom-up method of synthesis – Colloidal synthesis, solgel method, Self-assembly methods.

**Unit IV: Physicochemical characterization on Nanomaterials:** Optical method (UV - Vis absorption and fluorescence spectroscopy), electron microscopy techniques (SEM and TEM).

**Unit V: Applications of Nanotechnology:** Environmental applications – Green nanotechnology- green synthesis of nanoparticles, Nanomaterials as solution to environmental problems. Pesticide removal in ground water using nanoparticles. Industrial applications of nanotechnology; Cosmetic Industry – nanoparticles based sunscreens, antimicrobial creams. Food Industry – Antimicrobial coatings and smart packaging. Nanomaterial based food supplements. Textile Industry – Stain resistant textiles, self-cleaning and flame resistant textiles. *Agriculture sector* – Crop improvement, Nano-fertilizers. Nanomedicine – Cancer Nanotherapy and Point of care diagnostics

# **Reference Books:**

- 1. A.Nabok, "Organic and Inorganic Nanostructures", Artech House, 2011
- C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2017
- 3. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2012

# ALLIED PRACTICAL-III&IV: BIOINFORMATICS & NANOTECHNOLOGY 3 Credits

- 1. To calculate the absorption coefficient from UV-Vis spectrometer
- 2. To do the peak analysis of IR transmission spectrum using FTIR spectrometer
- 3. Trace out the emission spectra for UV excited luminescent sample
- 4. To determine particle size of nanoparticles using UV spectra
- 5. To synthesis nanoparticles using colloidal method

#### SKILL BASED PAPER II Tissue Culture 4 Credits

**Objectives:** This skill based course introduces the students to the concepts in tissue culture applicable to plants and animals

**Outcomes:** They are also taught their applications in biotechnology and biochemical research. This course introduces the students to explore entrepreneurial avenues in this field

**Unit I:** Types of Plant Cultures: Introduction to organogenesis, Production of haploid plants and their applications, Ovary and ovule culture, In vitro pollination and fertilization, Pollen culture, Anther culture, Embryo culture: History and methodology, Embryo rescue after wide hybridization, Applications, Somatic embryogenesis, Endosperm culture and production of triploids, Single cell suspension cultures and bioreactors, Protoplast isolation and culture, Meristem, axillary and shoot tip culture: micro propagation

**Unit II:** Applications of Plant Tissue Culture, Soma clonal variation and applications, Somatic Hybridization and its applications, Virus free plants, Germplasm conservation, Synthetic seeds, DNA transformation methods in plants and applications, Hairy root culture, Secondary metabolite production

**Unit III:** Types of Animal cell culture, Organ culture, Primary explant cultures, and Established cell lines, commonly used cell lines: origin and characteristics, Growth kinetics and cells in culture, Bioreactors for large scale culture of cells, Cell fusion, Transplantation of cultured cells (Grafting)

**Unit IV:** Applications of animal cell culture, Limitations and ethical issues, Transfection and transgenic animals, Expressing cloned products in animal cells, The need to express in animal cells, Over production and processing of chosen protein, Production of special secondary metabolites/ products (insulin, growth hormone, interferon, t – plasminogen activator, factor VIII etc), Production of vaccines using animal cell culture, Production of monoclonal antibodies and its applications, In vitro fertilization

**Unit V:** Study of laboratory equipment's, Stocks and Media preparation, Sterilization techniques in plant tissue culture, Explant selection, treatment and inoculation, Subculture of initiated cultures, Acclimatization of cultures, Extraction of proteins from plants and its estimation, Extraction of DNA/RNA from plants and its estimation, Estimation of peroxidase activity in plants, Study of  $\beta$  – amylase enzyme from germinated pulses, Demonstration of animal cell culture technique.

# **Reference Books:**

- 1. Plant Tissue Culture, Theory and Practice, Rev Ed S. S. Bhojwani, M.K. Razdan. (2015)
- 2. Animal Cell Culture and Technology- M Butler. (2014)
- 3. Freshney's Culture of Animal Cells. (2011).

# SEMESTER V

#### CORE PAPER VI ENVIRONMENTAL CHEMISTRY 4 Credits

**Objectives:** This course describes the chemistry of atmosphere, water bodies, soil, oxidation and reduction, fates of organic compounds in the environment. The student learns about the role of chemistry in understanding the atmosphere, water bodies and soil.

**Outcomes:** At the end of the course, the students will have an understanding on the chemistry of water bodies, greenhouse effects and soil chemistry

**Unit I:** Composition and structure of earth-atmosphere, hydrosphere, lithosphere, biosphere, Distribution of temperature and pressure in atmosphere, particles, ions, radicals in atmosphere, Thermal Inversion, Chemical and photochemical reaction in atmosphere, oxygen and ozone chemistry, Causes and effect of Greenhouse effect, Ozone Hole, Acid Rain, El-Nino and La Nino

**Unit II:** Fundamentals of Aquatic Chemistry: Dissolution/Precipitation Reactions, Complexation Reactions in Freshwaters, Species Distribution in Freshwaters, Nutrients in Water and Sediments, Organic Matter and Organic Chemicals, Seawater Composition and Chemistry- Salinity Concepts, Oceanic Circulation, Major Constituents, Dissolved Gases, Nutrients, Trace Elements, Sediments and Sedimentary Components

**Unit III:** Chemistry of the Solid Earth: Mineral Components of Soil, Primary and secondary Minerals, Weathering Processes, Organic Components, Soil pH and Redox Potential, Ion Exchange (Physisorption), Ligand Exchange (Chemisorption), Complexation/ Chelation, Precipitation/ Dissolution

**Unit IV:** Oxidation-Reduction, Significance, Electron and Redox Reactions, Electron Activity and pE, The Nernst Equation, Reaction Tendency, Nernst Equation and Chemical Equilibrium, Limits of pE in Water, pE Values in Natural Water Systems, pE-pH Diagrams, Corrosion, Stoichiometry, CO<sub>2</sub> Equilibria

**Unit V:** Fates of Organic Compounds, Diversity of Organic Compounds, Identifying Sources of Hydrocarbons, Chemical Partitioning, Chemical Transformation and Degradation, Light Absorption and the Beer-Lambert Law, Photolysis in Aqueous Systems, Photochemistry of Brominated Flame Retardants (BFRs), Physical Behavior of Particles in the Atmosphere, The Composition of Inorganic Particles, Radioactive Particles, Composition Of Organic Particles, Effects Of Particles, Water As Particulate Matter.

- 1. Brady, N.C. 2015. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
- 2. Botkin, D.B and Kodler E.A., 2014, Environmental Studies: The earth as a living planet. John Wiley and Sons Inc.
- 3. Rao M.N. and H.V.N. Rao, 2015 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
- 4. Tyler Miller Jr. G. 2017. Living in the Environment. Wadsworth Publishing Company, Belmont California.

- 5. Odum, E.P., 2017, Basic Ecology. Halt Saundurs, International Edition Japan.
- 6. De, A.K. 1990, Environmental Chemistry, Wiley Eastern Ltd., New Delhi.

# CORE PAPER II ENVIRONMENTAL POLLUTION 4 Credits

**Objectives:** The students in this course learn about the various kinds of pollution that occur in the environment. They learn about air, water and soil pollution, climate change and health and environment.

**Outcomes:** Through this course, the students learn the importance of environment and methods to minimize the pollution. This course prepares the students to be responsible citizens

**Unit I:** Air pollution: sources of air pollution, Primary and secondary air pollutants, Origin and effects of  $SO_x$ ,  $NO_x$ ,  $CO_x$ , CFC, Hydrocarbon, Photochemical smog, Acid rain, control of air pollution.

**Unit II:** Soil pollution: Causes of soil pollution, Effects of soil pollution, Pesticides in soil environment and their effects, Biological magnification, control and abatement measures, mining and environmental problems and soil erosion.

**Unit III:** Water pollution: Sources and types of water pollution, Effects of water pollution on living organism, Eutrophication, A brief idea sources, effects and control measures of marine pollution, ground water pollution, thermal pollution.

**Unit IV:** Climate change: Causes, effects and mitigation of climate change, advanced techniques and methods in pollution control- catalytic converter, settling chambers, scrubber, electrostatic precipitators and cyclonic separators.

**Unit V:** Health and environment Types of diseases (water borne diseases, respiratory hazardous), climate change and human health, heavy metals and human health (Mercury, Lead, Cadmium, Arsenic), Radiation, types and effect of UV radiations on biological systems.

- 1. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
- 2. Sodhi G.S. 2015, Fundamentals of Environmental Chemistry: Narosa Publishing House, New Delhi.
- 3. Khopkar, S.M. 2014. Environmental Pollution Analysis, Wiley Eastern Limited New York.
- 4. Rao M.N. and H.V.N. Rao, 2012: Air Pollution, Tata McGraw Hill Publishing

Co. Ltd., New Delhi.

- 5. Wild A., 2012: Soils and the Environment, Cambridge University Press, Cambridge.
- 6. Tyler Miller Jr. G. 2014. Living in the Environment. Wadsworth Publishing Company, Belmont California.

# CORE PAPER VIII ENVIRONMENTAL MONITORING & TECHNIQUES 4 Credits

**Objectives:** The aim of this course is to impart the knowledge of the various methodologies that are adapted for effective monitoring of environmental parameters. The students learn about data collection, water quality parameters, sampling methods, modeling in environmental sciences and application of computer technology in monitoring.

**Outcomes:** At the end of the course, the students are well versed in the various monitoring technologies for sampling environmental samples.

**Unit I:** Environment monitoring: Concept, aims, measurement and data collection on Meteorological parameters – solar radiation, temperature, Humidity, precipitation, wind direction and speed. Plume behavior, wind rose – a brief idea, Sampling of gaseous and suspended particulate matter; basic considerations, devices and methods used: absorption, adsorption, condensation, sedimentation, filtration, Impingement, electrostatic precipitation, centrifugal methods

**Unit II:** Water quality monitoring: water quality parameters, Physical and chemicals characteristics of water: Color, turbidity, odor and taste, total solids, conductivity, pH, acidity, alkalinity, hardness, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen demand, Bio indicators of environmental monitoring. Microbiological quality of water, Bio indicators of water quality, Vegetation monitoring – a brief idea.

**Unit III:** Sampling methods: Random and non-random sampling – concepts of mean (Arithmetic mean, Geometric mean, Harmonic mean), mode, median, Standard deviation and Standard error t-test and Chi. Square test

**Unit IV:** Modeling in Environmental Science-Mathematical model, possible steps in modeling approach, limitation of models, Basic environmental techniques: Neutron Activation Analysis, Anodic Stripping Voltammetry. Colorimeter, Flame photometry, Chromatography (HPLC), Atomic absorption Spectrophotoscopy, X-ray Fluorescence, Fourier Transform Infrared spectroscopy

**Unit V:** Computer application in ecology and environmental monitoring, Data tabulation of meteorological parameter, weather forecasting, EIA-Aims, objectives and methods. EIA case studies river valley, projects and thermal power plants.

- 1. Botkin, D.B and Keller E.A., 2011: Environmental Studies: The earth as a living plant. Charles E. Merrill, Publishing Co. London.
- 2. Botkin, D.B and Keller E.A., 2011: Environmental Science; Earth as a Liv-

ing Planet, John Wiley and Sons Inc., New York.

- 3. Manahan, S.E. 2010. Environmental Chemistry, Seventh Edition, Lewis Publishers, New York.
- 4. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
- 5. Gupta S.P. 2015, Statistical Methods, Sultan Chand and Sons, New Delhi.
- 6. Upadhaya A, Upadhaya K, Nath N, 2014, Bio Physical Chemistry, Principles and Techniques, Himalaya Publishing House, New Delhi.

#### CORE PRACTICAL-V 4 Credits

- 1. Demonstration of Reverse osmosis technique
- 2. Demonstration of adsorption technique.
- 3. Demonstration of Bio indicators of water quality
- 4. Determination of oil & grease in a given sample
- 5. Measurement of intensity of light using Lux meter
- 6. Microbial Plating technique
- 7. Demonstration of chromatographic technique
- 8. Demonstration of advanced instrumentation techniques
- 9. Quantitative analysis of NPK of soil
- 10. Quantitative analysis of Nitrogen of soil

#### ELECTIVE PAPER I A WATER & WASTEWATER TREATMENT 4 Credits

**Objectives:** The purpose of this course is to introduce the concept of water and waste water treatment techniques. The students learn about water resources, water treatment methods, waste water treatment and techniques for water treatment.

**Outcomes:** At the end of the course, the student is well aware on the principles involved in proper treatment of both water and waste water.

**Unit I:** Introduction: Water resources, Water demand, total requirement of water for a town & city, per captia demand, factors affecting water demand, variations in demand, design periods.

**Unit II:** Water Treatment: Importance & necessity for planned water supply, Need for water treatment, Methods for purification of water – Screening, primary settling tank, filtration & disinfection.

**Unit III:** Wastewater: Types of wastewater, Wastewater Characteristics- Physical, Chemical & Biological, Importance of improved wastewater characterization, Wastewater flow rates and constituent loadings

**Unit IV:** Wastewater Treatment: Introduction, Methods of treating domestic waste water – Screening, Primary Settling tank, Grit Chamber, Secondary & tertiary treatment of wastewater.

**Unit V:** Advanced Water & Wastewater treatment: Water – Softening, Adsorption, Desalination, Reverse Osmosis, and Wastewater - Floatation, Nitrogen & Phosphorus removal, Water Quality Standards, Guidelines for effluent discharge.

# **Reference Books:**

- 1. Fair, G.M., Geyer J.C and Okun, (2014) "Water and Waste water engineering" Vol II, John Wiley Publications.
- 2. Weber W.J., (2015) "Physico Chemical Processes for Water Quality Control".
- 3. Peavy, H.S., Rowe and Tchobonoglous, G., 2012, "Environmental Engineering", McGraw Hill
- 4. Raju, B.S.N., (2015), "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt. Co. Ltd., New Delhi.
- 5. Benefield R.D., and Randal C.W., 2011, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey.
- 6. Metcalf and Eddy Inc., (2013), "Wastewater Engineering Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

# ELECTIVE PAPER I B ENVIRONMENTAL BIOTECHNOLOGY 4 Credits

**Objectives:** The students are introduced to the biological revolutions in this field. They are taught about the microbial populations, bio-geo magnification. They learn

about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.

**Outcomes:** The students will be able to demonstrate the use of environmental science principle in solving various environmental problems

**Unit I:** Biochemistry: Introduction, Lipids, sugars, polysaccharides, nucleotides, RNA, DNA, amino acids, proteins, hybrid biochemical, hierarchy of cellular organisms.

**Unit II:** Multiple interacting microbial populations: Neutralism, mutualism, comt mensalism and amensalism. Classification of interaction between two species. Bio concentration, bio/ geo-magnification.

**Unit III:** Biotechnology: Introduction to microbial biotechnology, uses of enzymes and biomass production, isolation and purification of enzyme engineering, Sewage treatment using microbial systems, nitrogen fixing and pollutant degrading genes, biocontrol agents.

**Unit IV:** Uses of microbes: Isolating and culturing of microorganisms, production of organic compounds like, ethanol and acetone by microbial fermentation, production of enzymes by microorganism.

**Unit V:** Specific biotechnological applications to pollution control, restoration of degraded lands, free-cells and immobilized cell technology for wastewater treatment aerobic and anaerobic digestion, biogas from wastes. Bio techniques for air pollution abatement and odor control.

# **Reference Books:**

- 1. Biochemical Engineering and Fundamentals– Bailey and Ollis, (2014), Mc-Graw Hill International Edition
- A Textbook of Biotechnology– Dubey, R.C., S. Chand and Co., New Delhi. (2014).
- 3. Elements of Biotechnology Gupta, P.K., (2011), Rastogi Publications, Meerut.
- 4. Chemistry for Environmental Engineering and Science– Sawyer, C.N., Mc Carty, P.L., and Parkin, G.F., (2013),5th Edition, TMH Edition, Tata Mc Graw Hill Co. Ltd.,New Delhi.
- 5. Environmental Molecular Biology, Paul. A, Rochelle, 2011. Horizon Press.
- 6. Industrial and Environmental Biotechnology, Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, 2016. Horizon Press.
- 7. Waste water engineering treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi. 2014
- 8. Environmental Chemistry (2015), AK. De, Wiley Eastern Ltd, New Delhi. ELECTIVE PAPER IC

# AGRICULTURAL BIOTECHNOLOGY 4 Credits

**Objectives**: This course teaches the students approaches to manipulate and improve plant yield, throws light on transgenic plants. They are introduced to the concept of utilizing plants for production of vaccines and production of bio fertilizers.

**Outcomes:** These students will be able to understand the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use

**Unit I:** Biotechnology in agriculture, growth and historical perspective of agricultural biotechnology. Agriculture biotechnology –Risks and applications.

**Unit II:** Transgenic plants resistance to biotic and abiotic stress. Transgenic plants in crop improvement. Advantages and applications of transgenic plants.

**Unit III:** Transgenic plants in quality modifications–Starch, Oil, Protein, Golden Rice, Suppression of endogenous gene, Male sterilization.

**Unit IV:** Plants derived vaccines, flower modification and color, targeting transgenic product to chloroplast and mitochondria.

**Unit V:** Biofertilizers, importance of Bio-fertilizers in agriculture (Rhizobium, Azotobacter, mycorrhiza, Actinorhiza) advantages and current status, vermi culture, composting, current practices and production of biofertilizers.

- 1. Biotechnology fundamental and application (4th edition, 2011) by S.S.Purohit.
- 2. Plant Biotechnology (2011) by B.D.Singh
- 3. Plants, Genes and agriculture (2012) by Maartein, J.Christpeels, David E.Sdava.
- 4. Crop Biotechnology (2015) by P.R.Yadav, Rajiv Tyagi.
- 5. Plant Biotechnology (2013) by Chawla.Gendel,
- 6. Steven M. Agricultural Bioethics: Implications of Agricultural Biotechnology (2015).

# ELECTIVE PAPER I D

# MEDICAL BIOTECHNOLOGY 4 Credits

**Objectives:** The students are introduced to the biological revolutions in this field. They are taught the role of biotechnology in the worldwide market. They learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.

**Outcomes:** The students will be able to demonstrate the use of biotechnology in solving various medical problems.

**Unit I:** Tools of Medical Biotechnology–Biotechnological revolutions- Genomics, combinatorial chemistry, insight into basic biology-Areas of application, Diagnosis and prediction of disorders Limits and approaches.

**Unit II:** Role of biotechnology in health care. World-wide market and work in medical biotechnology. Vaccine production-New developments.

**Unit III:** Biosensors in clinical diagnosis, chiral technology, monoclonal antibodies for immunotherapy.

**Unit-IV:** Recent developments in medical biotechnology–Pharm for human proteins and neutraceuticals. Tissue engineering and therapeutic cloning, Application of nanotechnology in biomedical sciences- Green nano substances.

**Unit V:** Gene delivery, Drug delivery. Nanotechnology in replacing defective cells.

#### Reference Books:

- 1. Fundamentals of medical biotechnology (2015) by Aparna Rajagopalan, Ukaaz publications.
- 2. Medical biotechnology (2014) by S.N.Jogdand, Himalaya publications.

#### ELECTIVE PAPER I FERMENTATION TECHNOLOGY 4 Credits

**Objectives:** The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine.

**Outcomes:** At the end of the course, the student will have a better appreciation for the role of microbes in industry using technology.

**Unit I:** Introduction to fermentation technology, History of fermentation, fermentation processes, Biomass, enzymes and metabolites. Process components. Batch, continuous and fed-batch cultures. Fermenting media formulation: Carbon and nitrogen sources. Oxygen requirements and process optimization.

Unit II: Design and operation of Fermenters, Basic concepts for selection of a re-

actor, packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor.

**Unit III:** Microbial culture selection for fermentation processes: Isolation, maintenance and development of microorganisms. Starter utilization. Immobilization of biocatalysts: kinetics effects. Inactivation kinetics.

**Unit IV:** Bio-catalysis: in non-conventional media (biphasic; organic; ionic liquids; supercritical fluids).

**Unit V:** Down Stream processing. Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis. Bioprocess economics. Bio product regulation. General fermentation economics.

# **Reference Books**:

- Biely, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (2014) Megraw Hills. Rehm, H.J. and Reed G (ed), Biotechnology, Vol 1-2, Verlag chemie.
- 2. Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (2014) Pergamon Press.
- 3. Pirt, S.J. Principles of Microbial and Cell Cultivation (2014). Blackwell Scientific Publication, London.
- 4. Moo-young M. Comprehensive Biotechnology (2015). Vol. 1-4 Pergamum Press Oxford.

# **ELECTIVE PAPER 1**

# MICROBIAL CULTURE TECHNIQUE 4 Credits

**Objectives:** The students in this course learn different types of pure culture techniques, preservation of pure culture and culture collection centers. This course also introduces the students to the different types of media and teaches about isolation of strain and improvement.

**Outcomes:** By the end of the course, the students will be able to isolate cultures in pure form and preserve cultures for further use in research studies

**Unit I:** Microbial culture techniques: Definition, Pure culture and axenic culture, Principles and methods of obtaining pure culture, Preservation of pure culture, culture collection centers.

**Unit II:** Definition and Significance of Streak plate, Pour plate, Spread plate. Single Cell isolation. Cultivation of Bacteria: Media used, Properties of good culture media.

**Unit III:** Definition, Concept, Use and Types of different culture media. Synthetic, Non- synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium. Buffers in culture medium.

Unit IV: Measurement and Kinetics of Microbial Growth, Scale up of microbial

process.

**Unit V:** Isolation of microbial products. Strain isolation and improvement. Applications of Microbial technology.

# **Reference Books**:

- 1. Bisen P.S., Varma K: Handbook of Microbiology (2011). CBS Publishers and Distributors, Delhi.
- 2. Dubey R.C. and D.K. Maheshwary, A textbook of Microbiology (2012). S Chand and Co. New Delhi.
- 3. Pelczar Michael J., Jr., E.C.S. Chan, Elements of Microbiology (2012). Mc-Graw, Hill International. Book Company, New Delhi.
- 4. Pelczar Michael J., Jr. E.C.S Chan, Noel R.Krieg: Microbiology: Concepts and applications (2011). McGraw Hill Inc.
- 5. Pelczar Michael J., Reid R.D. and Chan E.C.S.: Microbiology (2014). Tata McGraw hill publishing Co. Ltd., New Delhi.
- 6. Powar C.B. and Daginawala H.F. General Microbiology (2012). Vol I and II Himalaya publishing house Bombay.
- 7. Prescott L.M., Harley J.P., and Klein Donald A. Microbiology (2015). W.M.C., Brown publishers.

# SKILL BASED PAPER III

# ADVANCE INSTRUMENTATION TECHNIQUES 4 Credits

**Objectives:** This skill based course will teach the students the various instrumentations that are used in the analytical laboratories. This course covers both fundamental and applications of the instruments that are routinely used for the characterization of biomolecules

**Outcomes:** At the end of the course, the student has the basic knowledge on the theory, operation and function of analytical instruments.

**Unit I:** NMR spectroscopy: Principle, Instrumentation, Solvents used in NMR, NMR signals in various compounds, Chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, <sup>13</sup>C NMR, 1D and 2D NMR, NOESY and COSY techniques, Applications of NMR spectroscopy.

**Unit II:** Mass Spectroscopy: Principle, Instrumentation of Mass Spectroscopy, Types of ionization like electron impact, chemical, field, FAB and MALDI, Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Tandem Mass Instruments, Applications of Mass spectroscopy

**Unit III**: Chromatography: Principle, Apparatus / Instrumentation, Chromatographic parameters, Factors involved, Endpoint determination and Applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) GC-MS g) High Performance Liquid chromatography h) LC-MS i) High Performance Thin Layer chromatography k) Super critical fluid chromatography l) Affinity chromatography.

**Unit IV**: Electrophoresis: Principle, Instrumentation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis.

**Unit V**: X ray Crystallography: Production of X rays, Different X ray methods, Braggs law, Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction.

- 1. Bisen P.S., Varma K: Handbook of Microbiology CBS Publishers and Distributors, Delhi
- 2. 4Pelczar Michael J., Jr. E.C.S Chan, Noel R.Krieg: Microbiology: Concepts and applications-McGraw Hill Inc. Pelczar Michael J., Reid R.D. and Chan E.C.S.: Microbiology, Tata McGraw hill publishing Co. Ltd., New Delhi.
- 3. Powar C.B. and Daginawala H.F.: General microbiology Vol I and II Himalaya publishing house Bombay.
- 4. Prescott L.M., Harley J.P., and Klein Donald A.: Microbiology, W.M.C., Brown publishers

# **SEMESTER VI**

#### CORE PAPER IX ENVIRONMENTAL MANAGEMENT 4 Credits

**Objectives:** This course introduces the students to the principles of environmental management. In the course, the students are taught environmental audits, environmental economics and environmental ethics.

**Outcomes:** By the end of the course, the students have a better understanding on how to be responsible citizens by managing the environment around us.

**Unit I:** Principles of Environmental management, Environmental risk assessment-concept, Risk evaluation-hazard identification, exposure assessment, Hazard assessment, risk characterization, Public Perception of risk, Risk Communication

**Unit II:** Concept of environment and development, Trade and Environment, Complex Issue, World trade organization, Dispute at WTO, politics of Dispute

**Unit III:** Environmental Audit-concept, setting up an Audit programme, typical Audit Process, typical Audit Process, carrying out audit, benefit and Environmental Audit programme in India

**Unit IV:** Environmental economics-concept, Economics of pollution control, cost effective analysis, concept of environmental accounting, National Account Statistics in India

**Unit V:** Environmental ethics, Environmental education- background, goal, objective, Environmental awareness, Role of NGO in Environmental Management

- 1. Santra. S.C, Environmental Science (2014), New central book agency, Kolkata, India
- 2. Atlas, R.M. and Bartha R., 2017: Microbial Ecology; Fundamentals and Applications. 2nd Ed. Reading Mass, Addison Wesley.
- 3. Lim, D.V. 2011: Microbiology West Publishing Company, New York.
- 4. Morgen, M.D. Morgen J.M. and Wiersima J.H. 2011, Environmental Science: Managing Physical and Biological Resources Wm C Brown Publishers London.
- 5. Owen, O.S and Chiras D.D., 2012: Resource Conservation. An Ecological Approach. Macmillan Publishing Company, New York.

# CORE PAPER X ECO-RESTORATION & DEVELOPMENT 4 Credits

**Objectives**: Eco-restoration course teaches the students the methodology to reclaim waste land, soil conservation, green technology, environmental policy and sustainability.

**Outcomes**: The students in this course understand the role of restoration processes to reclaim degraded land, help soil conservation, familiarity with environmental policies at state, national and international level

**Unit I:** Degraded lands: agricultural practices and land degradation, Mining and its impact on soil quality, Conservation of degraded lands, Rehabilitation of mine soils and salt affected soils, restoration of lakes-case studies

**Unit II:** Soil Conservation: Biological reclamation techniques, Bio fertilizers, Microrhizae, Vermi compositing, Afforestation, Organic farming, Bio remediation

**Unit III:** Concept of green technology-Eco development and environmental friendly products and technologies, REDD plus, Restoration of Coastal Zone, Coral Reef and Mangroves

**Unit IV:** National and international environmental policy, Environmental laws in India-Environmental Protection Act, Water Act, and Air Act

**Unit V:** Sustainability– concept, principles and practices, Sustainable management of resources, Ecological modeling – a brief idea, Geographical Information System, Remote sensing and application in environment

# **Reference Books:**

- 1. Tyler Miller Jr. G. 2012. Living in the Environment. Wadsworth Publishing Company, Belmont California.
- 2. Cunningham. W.P., 2014, Understanding Our Environmental: An Introduction W.C. Brown Publishers, Oxford.
- 3. Singh J.S., 2013, Restoration of degraded lands, Rastogi Publications, Meerut.
- 4. Singh J.S., Singh S.P. and Gupta S.R., 2016, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

# CORE PRACTICAL-VI

- 1. Identification of fungus
- 2. Multiple tube fermentation technique.
- 3. Membrane filtration technique
- 4. Gram Staining technique
- 5. Demonstration of endanger species
- 6. Demonstration of Microbiological quality of water
- 7. Experimental studies on disinfection process
- 8. Visit to in situ or ex situ conservation center
- 9. Recreational water quality Analysis
- 10.To determine basal cover of trees in a forest ecosystem/forest plantation.

#### ELECTIVE PAPER IIA ECOTOURISM 4 Credits

**Objectives:** This course introduces the students to the basics of healthy promotion of tourism with environmental perspective.

**Outcomes:** At the end of the course, the student will be able to apply these learning to practical use.

**Unit I:** Tourism: Concepts, Definition and Historical development of tourism. Distinction between Tourist-Traveler-Visitor-Excursionist. Types and Forms of Tourism; Tourist system Nature, characteristic. Components of tourism and its characteristics.

**Unit II:** Domestic and International tourism: Domestic tourism: features, pattern of growth, profile. International tourism: Generating and Destination regions. Pattern of growth and Profile.

**Unit III:** Places of interest of ecotourism: Wildlife Sanctuaries (Bharatpur Bird Sanctuary, Biligiri Rangaswamy Temple), National Parks (Jim Corbett Tiger Reserve, Kanha NP, Kaziranga NP, Gir NP,) and Biospehere reserves in India (Nilgiri BR, Sunderbans BR, Seshachalam Hills BR). Hill Stations: Study of Hill Station attractions and their environs with case studies of Mussoorie, Nainital, Munnar and Ooty. Beaches: Beaches in Goa, Kerala, Orissa. Islands: Andman Nicobar & Lakshdvip islands.

**Unit IV:** Tourism Impacts: Positive and Negative Impacts of Tourism: Socio - cultural, Economic, Environmental and Political. Factors affecting ecotourism impacts, Ecotourism as a tool for sustainable development.

**Unit V:** Ecotourism related organizations: History, objectives and role of UNWTO, WTTC, TAAI, IATO, IATA, and ITC in promoting ecotourism, Role of environmental education in ecotourism.

# **Reference Books:**

- 1. Bhatia. Tourism Development, 2000, New Delhi, India
- 2. Seth: Tourism Management, 2000, Pune, India
- 3. Kaul: Dynamics of Tourism, 1999, New Delhi, India.
- 4. Mill and Morrison The Tourism system an Introductory Text (2000)) Prentice Hall
- 5. Cooper, Fletcher, Tourism, Principles and practices (1999) Pitman
- 6. Burkart and Medlik Tourism, Past, Present and Future (1981) Heinemenn, ELBS.
- 7. P.S. Gill, Dynamices of Tourism (4 Vols) Anmol Publication.
- 8. P.C. Sinha, Tourism Management. Anmol Publication. 1999
- 9. P.C. Sinha, Tourism Evolution Scope Nature & Organization. Anmol Publication.

#### ELECTIVE PAPER IIB ENVIRONMENTAL TOXICOLOGY 4 Credits

**Objectives:** This course is designed to impart the basics in toxicological aspects

that effect the environment. The students learn about toxicology, chemical carcinogenesis, epidemiology and environmental health.

**Outcome:** The outcome of this course is to provide the necessary knowledge to the students to understand the basic toxicological aspects

**Unit I:** Basic Definitions and Terminology, Concept, Importance and the Dose–Response Relationship, Factors Influencing Dose–Response Curves, Descriptive Toxicology: Testing Adverse Effects of Chemicals and Generating Dose–Response Data, Extrapolation of Animal Test Data to Human Exposure

**Unit II:** Toxicology and safety, Transfer across Membrane Barriers, Absorption, Distribution, and Elimination of Toxic Agents, Sites of Biotransformation, Biotransformation Reactions, Hematotoxicity: Basic Concepts and Background, Direct Toxicological Effects of CO<sub>2</sub>, Inorganic Nitrates/Nitrites and Chlorate Salts.

**Unit III:** Chemical Carcinogenesis: Terminology of Cancer, Carcinogenesis by Chemicals, Molecular Aspects of Carcinogenesis, Testing Chemicals for Carcinogenic Activity, Occupational Carcinogens, Cancer and Our Environment

**Unit IV:** Properties and Effects of Metals: Classification of Metals, Speciation of Metals, Pharmacokinetics of Metals, Toxicity of Metals, Sources of Metal Exposure, Toxicology of Selected Metals-Fe, Hg, Pb, Ar, Cr, Properties and Effects of Pesticides: Organophosphate and Carbamate Insecticides

**Unit V:** Epidemiology and Environmental Health: History of Epidemiology, Epidemiologic Causation, Types of Epidemiologic Studies: Advantages and Disadvantages, Exposure, Disease and Human Health Effects, Measurement of Disease or Exposure Frequency

- 1. Phillip L. Williams, Robert C. James, Stephen M. Roberts, Principles of Toxicology-Environmental and Industrial Applications (2nd Edn.), AWiley-Interscience Publication, Johnwiley & Sons, Inc. 2014.
- 2. John H. Duffus, Howard G. J. Worth, Fundamental Toxicology, Published by The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF, UK. 2015

#### ELECTIVE PAPER IIC BIO- PROCESSING & SEPARATION 4 Credits

**Objectives:** The course introduces the analytical methods used in separation science. They learn about various analytical techniques that are routinely used for separation of biomolecules and their components

**Outcomes:** The course teaches students the advantages of separation science as applied to biotechnology.

**Unit I. Classification of Bioproducts:** Small molecules, Macromolecules-Proteins, Nucleic acids and nucleotide, Polysaccharides, Engineering analysis.

**Unit II: Analytical methods:** Biological activity, Analysis of purity-Electrophoresis, HPLC, HPLC-Mass Spectrophotometric assay, Microbiological assays.

**Unit III: Cell lysis and Flocculation:** Cell structure- Prokaryotic cells, Eukaryotic cells, Cell lysis- Chemical and mechanical methods, Flocculation- Electric double layer, Flocculation rate.

**Unit IV:** Filtration: Filtration principles- Conventional and crossflow filtration, filter media and equipment, membrane fouling, scaleup and design of filtration system.

**Unit V:** Equation of motion, Equilibrium sedimentation, Sedimentation coefficient, Equivalent time, Production centrifuge, Ultracentrifugation. Sedimentation at low acceleration, partitioning equilibria, Phase separation, Countercurrent stage calculation, scale up and design of extractors.

- 1. Bioseparation and Bioprocessing: A Handbook, 2 Volume Set (2012). Ganapathy Subramanian (Editor) Wiley publishers.
- Introduction to Environmental Biotechnology- A K Chatterji (2011). Edition 2<sup>nd</sup>.

# ELECTIVE PAPER II D

# BIOTECHNOLOGICAL APPLICATION IN WASTE WATER MANAGEMENT 4 Credits

**Objectives:** The objective of this course is to introduce the students to the role of biotechnology in waste water management. The students learn about role of microbes in biodegradation, bioremediation and composting.

**Outcomes:** At the end of the course will be able to understand the treatment processes of waste water and also the knowledge of production of biogas.

**Unit I:** Historical introduction to water and waste water environment. Domestic and industrial waste water flow rate and characteristics. Design of waste water network, waste water treatment process. Biotechnology in Environment & Biodiversity: Waste Water Treatment, Biodegradation, Bioremediation, composting, Solid waste Management, chemical degradation, heavy Metals. Biofuel- Biodiesel, Biogas, Ethanol.

**Unit II:** Microorganisms & Agriculture – Microorganisms in Agricultural Waste water treatment, vermiculture, Microbial pesticides.

**Unit III:** Environmental Management – Concept of health and sanitation, environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases, health hazards due to pesticide and metal pollution, waste treatment, solid waste management.

**Unit IV:** Secondary classification, advanced treatment process – Granular media filtration, Absorption. Chemical treatment, air stripping and ammonia removal. Waste water disinfectant. Diffuses from waste water – plume flow, design. Treatment of waste water in Food processing, Paper, Sugar and Leather industry.

**Unit V:** Soil Tests, Percolation test, Aerobic digestion, anaerobic digestion, composting, Sludge disposal.

- 1. Purohit by Introduction to Biotechnology- Brown, Campbell, Priest- Panima Publications (2011)
- 2. Biotechnology by U Satyanarayana- New Age publications (2011).
- 3. Biotechnology by B.D. Singh, Kalyani Publications (2012)
- 4. Biotechnology: Expanding Horizone- B.D. Singh- Kalyani Publications. (2012)
- 5. A Text book of Biotechnology R.C. Dubey- S. Chand (2014).
- 6. Advances in Biotechnology- S.N. Jogd and- Himalaya Publication (2012).

#### ELECTIVE PAPER IIE BIOETHICS & BIOSAFETY 4 Credits

**Objectives:** This course is an introduction to the students on the ethical aspects of conducting research and safety aspects to be adhered in a research setting. This course also introduces the students to effective management of available resources and footprint of research activities.

**Outcomes:** At the end of the course, the student would have gained sufficient knowledge to act as a responsible scientist and environmentally conscious.

**Unit I:** Definition of ethics and Bioethics: Ethics in Biotechnology (positive and negative effects with classical examples–Rice with Vitamin A. No till Agriculture, cotton without insecticide, reduced need for fertilizer, biological pest control, slow ripening fruits and controlled ripening, fast growing trees and fishes.

**Unit II:** Awareness education on genetically engineered organism.-Transgene instability, gene flow, resistance/ tolerance of target organism, increase weed less ness, risks and uncertainty associated with biotechnology.

**Unit III:** Containment levels and their impact on Environment- Containment-definition, types of containment, summary of recommended Biosafety levels for infectious agents, detail checklist-premises and lab equipment, Animal facilities, environment.

**Unit IV:** Gene technology laboratory. GLP and Bioethics-introduction, national Good Laboratory Practices (GLP), the GLP authority functions, Good Laboratory Practices-necessity, aspiration and responsibility.

**Unit V:** Ethics in clinical trials and Good Clinical Practices (GCP) Definition of clinical trials and GCP, general information about clinical trials, need to conduct clinical trials, faces of clinical trials, institutional set ups for conducting clinical trials, ethics in clinical biotechnology.

- 1. Safety Assessment by Thomas, J.A., Fuch, R.L. (2002), AcademicPress.
- 2. Biological safety Principles and practices) by Fleming, D.A., Hunt, D.L., (2000).ASM Press.
- 3. Biotechnology- A comprehensive treatise. Legal economic and ethical dimensions VCH. Bioethics by Ben Mepham, Oxford University Press, 2005.
- 4. Bioethics & Biosafety by R Rallapalli & GeethaBali, APH publication, 2007
- 5. Bioethics& Biosaftey By Sateesh Mk (2008), IkPublishers
- 6. Biosafety And Bioethics Rajmohan Joshi Publishers

#### ELECTIVE PAPER IIF MICROBIAL DISEASES CONTROL 4 Credits

**Objectives**: This course is designed to impart knowledge on infectious disease epidemiology, investigating the outbreak and the role of public health laboratories in disease surveillance. The students are taught on the various infectious diseases, mode of transmission and different evaluation and control strategies. The students would also be able to appreciate behavioral changes in HIV patients, blood safety and immigrant health.

**Outcomes:** The student at the end of the course will be able to gain knowledge about vaccination, screening of various diseases and modeling infectious disease data.

**Unit I:** General principles of infectious disease epidemiology, including: Principles of Infectious Diseases; Outbreak Investigation.

**Unit II:** Role of the Public Health Laboratory; Disease Surveillance; Modeling Infectious Disease Data, Principles of Screening and Screening Tests.

**Unit III:** Major infectious diseases and modes of transmission, including: Food borne Illness; Zoonotic Diseases; Tuberculosis; Influenza; Vector-Borne Diseases; Malaria; Other Parasitic Diseases; HIV/AIDS; Sexually Transmitted Diseases; Viral Hepatitis; Antibiotic Resistant Bacteria.

**Unit IV:** Different control and evaluation strategies for infectious diseases, including: Vaccination; Nosocomial Infections.

**Unit V:** Behavior Change and HIV/STDs; Blood Safety; Immigrant and Refugee Health; International Research in Resource Poor Settings; Critical Reading of Medical Literature.

- 1. "Infectious Disease Epidemiology", Second Edition, edited by Kenrad Nelson and Carolyn Williams. Jones and Bartlett, 2007.
- 2. "Control of Communicable Diseases Manual", 19th Edition, edited by David L. Heymann. American Public Health Association, 2008
- 3. Riegelman, R. (2010) Public Health 101: Healthy People Healthy Populations, Sudbury, Massachusetts: Jones and Bartlett Publishers.
- 4. Pfizer. (2006). Milestones in Public Health: Accomplishments in Public Health over the Last 100 Years. New York: Pfizer Global Pharmaceuticals
- 5. Pfizer. (2003). Advancing healthy populations: The Pfizer guide to careers in public health. New York: Pfizer Global Pharmaceuticals
- 6. Pfizer. (2007). Moments in Leadership: Case studies in Public health Policy and Practice. New York: Pfizer Global Pharmaceuticals

#### ELECTIVE PAPER IIIA SOLID WASTE MANAGEMENT 4 Credits

**Objectives:** This course introduces the students on the various methods available for solid waste management. The course covers topics on composition, properties, transportation, separation, transfer and recycling of solid waste.

**Outcomes:** At the end of the course, the students will be able to appreciate all the aspects involved in solid waste creation, minimization and complete environmentally safe method of their disposal.

**Unit I:** Introduction: Definition, Sources – household, street, demolition, construction. Composition and Properties of Municipal Solid Wastes. Legislation and its impact.

**Unit II:** Engineering principles: Generation rates, Collection, waste handling and separation, storage and processing at the source.

**Unit III:** Collection, transfer and transportation: Types, equipment, personnel requirements, analysis & collection system, collection routes, types of transfer stations, transport means and methods.

**Unit IV:** Separation, transformation and recycling: Unit operations for separation and processing, size reduction, separation, density separation, fundamentals of thermal processing – combustion, pyrolysis, gasification, energy recovery system.

**Unit V:** Biological and chemical conversion technologies: Principles, Aerobic &, anaerobic composting and energy recovery. Incineration - Process, Types, Heat Recovery, Incineration Products, Air Pollution Control

- 1. George Tchobanaglous, Hilary Theissen and Samuel A. Vigil, (2013), Integrated Solid Waste Management: Engineering Principles and Management Issues–, McGraw-Hill Science Engineering.
- 2. Bhide and Sundaresan (2015), Solid Waste Management in Developing Countries, Indian National Scientific Documentation Centre. New Delhi.
- 3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (2016), Environmental Engineering, McGraw Hill Publishing company, New York.
- 4. Sincero, A.P., and Sincero, G.A., (2018), Environmental Engineering A Design Approach, Prentice- Hall of India Pvt. Ltd., New Delhi.
- 5. Sasikumar K and Krishna S. G., (2016), Solid Waste Management, PHI Learning Pvt. Ltd., New Delhi.

#### ELECTIVE PAPER IIIB HYDROLOGY 4 Credits

**Objectives:** This course introduces the students on the various methods available for solid waste management. The course covers topics on composition, properties, transportation, separation, transfer and recycling of solid waste.

**Outcomes:** At the end of the course, the students will be able to appreciate all the aspects involved in solid waste creation, minimization and complete environmentally safe method of their disposal.

**Unit I: Introduction:** Definition of hydrology, Importance of hydrology, Practical applications of hydrology, Global water availability, Water resource availability in India's. Water consumption pattern, Impacts of over exploitation of water.

**Unit II: Ground water hydrology and well hydraulics:** Scope and importance of ground water hydrology. Water bearing geological formations, Rock properties affecting ground water, ground water basins, springs, Aquifers - Definition, Types of aquifer, properties of aquifer, Vertical distribution of ground water.

**Unit III: Hydrological cycle** *Precipitation:* forms and types of precipitation. Measurement of precipitation (recording and non-recording type), Annual rainfall in India, Evaporation: Definition, Process, factors affecting evaporation, transpiration evapo-transpiration, reducing evaporation from water bodies, Infiltration: Definition, factors affecting infiltration, infiltration capacity, Measurement of infiltration.

**Unit IV: Water resources management:** Introduction. Water wealth in India, Importance of river basins, Saline water intrusion, water resources projects in India, advantages and disadvantages of water resources projects, Water resources management in India with special reference to Karnataka.

**Unit V: Rainwater harvesting:** Definition, need, objectives, elements and types of rainwater harvesting, Methods of ground water recharge, Advantage and limitations of rain water harvesting, Case study of rain water harvesting, traditional rain water harvesting.

- 1. Subramanya K, (2008), Engineering Hydrology Tata McGraw Hill, New Delhi.
- 2. Jaya Rami Reddy, (2005) A Text Book of Hydrology, Laxmi Publications, New Delhi.
- 3. H.M. Raghunath, (2009), Hydrology-Principle analysis and design, Wiley Eastern Publication, New Delhi.
- 4. Ven Te Chow, Larry W. Mays, David R. Maidment, (1988), Hand Book of Hydrology, McGraw Hill.

#### ELECTIVE PAPER IIIC: GENOMICS & PROTEOMICS 4 Credits

**Objectives:** This course aims to provide the knowledge and practical skills of functional genomics and proteomics. The course also teaches the techniques used in functional genomics such as microarrays, NGST, mRNA expression and miRNA expression.

**Outcomes:** By the end of the course, students will have the necessary learning to radically advance our understanding of life and transform medicine

**Unit I:** Introduction to genome data bases-data base search-Algorithm issues in databases search- sequence database search- FASTA-BLAST–Types of genomic data bases and uses: Polymorphic markers, Cytogenic Maps, LINE, SINE-Amino acid substitution matrices PAM and BLOSUM.

**Unit II:** Gene Therapy: Concept and Principles of Gene Therapy. Principles of gene Expression-Genome Mapping-physical and genetic mapping techniques, Human Genome Project- Genomes of other organisms. Shotgun DNA sequencing – Sequence assembly-Gene predictions-Molecular prediction with DNA strings.

**Unit III:** Genomic resources, Gene structure and DNA sequences. EST comparison, gene hunting. Expression analysis SAGE, cDNA library, ORF prediction, Microarray –DNA sequencing and sequence alignment: RFLP, SNP, RAPD, Application of Comparative Genomics.

**Unit IV:** Protein database: CATH, SCOP, FSSP, SARF, MM. Protein structure and comparison, Blocks, Class, Domain, Fold, Profile, Motif and PSSM.

**Unit V:** Structural Proteomics: Experimental Techniques for Protein Structure Elucidation, X-ray Crystallography, 2-D Electrophoresis- Sample preparation, pH gradient-MALDI-TOF, Electro plot, Protein Microarrays and Bio-separation.

Metabolomics: Understanding the Metabolic Pathways of Microbes, metabolic pathway databases - KEGG. Structure prediction, active site determination, neural networks. Protein–protein interaction, protein–DNA interaction. Enzyme Substrate interaction. Applications of Proteomics: Plant breeding and Biomedical.

- 1. Introduction to bioinformatics by Dr. Mani and Dr. Vijayaraj. Wiley Publisher
- 2. Bioinformatics by Parry and Smith (2005). Wiley Publisher
- 3. Bioinformatics by David Mount. Wiley Publisher
- 4. Genomes 3 by T. A.Brown. Wiley Publisher
- 5. Proteomics-Pennigton & Dunn (2002) Viva books publishers, New Delhi

#### ELECTIVE PAPER-IIID INDUSTRIAL BIOTECHNOLOGY 4 Credits

**Objectives:** The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine

**Outcomes:** At the end of the course, the student will have a better appreciation for the role of biotechnology in industry using microbes

**Unit I:** Fermenter-batch and continuous fermenter, general design of a stirred tank fermenter, sterilization and maintenance of sterile conditions.

**Unit II:** Preparation of inoculums, Types of fermentation- solid state fermentation- tray and drum, and submerged fermentation-batch and fed batch, Media used for industrial fermentation.

**Unit III:** Microbial production and product recovery-Alcoholic beverage-wine and beer. Production of vinegar from alcohol, production of vitamin- B12, production of organic acid-lactic acid and glutamate.

**Unit IV:** Fermented dairy products-microorganisms involved in fermentation, yogurt, curds, sour cream, cheese paneer, pickles, idly, single cell protein.

**Unit V:** Starting an Enterprise: Entrepreneur, business idea, Management, Marketing and Financial Planning.

- Industrial Microbiology, Prescot and Dunn, 2015
  Biochemical Engineering and Biotechnology אוסיים
- Biochemical Engineering and Biotechnology Handbook, Atkinson, Band Marituna, F., the Nature Press, Macmillan Pub-lisher 2015.
- Biochemical Engineering Fundamentals (2014), Bailey&Olis.MGH. Text book of Biotechnology- Plant Biotechnology and industrial biotechnology (2014) by S.B. Sullia, G. SivaKumarSwa-mi, P.A. Sastry-United publishers

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# VERMICULTURE TECHNOLOGY 4 Credits

**Objectives:** This course teaches about earthworm biology and role of earthworm in soil in association with microorganism. They also study the different earthworm species used in vermi-compost production and importance of vermicompost in organic farming.

Outcomes: At the end of the course, the students will be able to use vermicomposting as a tool for solid waste management, organic farming and be able to set up small-scale industry.

**Unit I:** Soil biota -Earthworms -Ecological classification of earth worms as Epigamic. Introduction to earthworm biology -physical and chemical effects of earth worms on soils. Unit II: Role of earthworms in soil -classification of earthworms based on ecological strategies- Burrowing activity of earthworms- Drilospheres -Microorganisms and their relationship with earthworms. Unit III: Composting -anaerobic composting, aerobic composting, types of composting, vermi-compost- earthworm species used in vermi-compost production - endemic species, exotic species.

Unit IV: Vermi compost -setting up vermi compost quality N, P, K, C, N, Microbial quality applications –vermi-culture –vermi wash - role of vermi compost in organic farming - its quality and advantages over chemical inputs.

ത Unit V: Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions. Vermicomposting as tool for solid waste management - a small scale industry.

- 1997, Vermicology: The Biology Earth worm Orient Longman Kale Radha, D 1998. Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore. Satchell, J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London Stephenson J, 1923. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
   Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London Ismail, S.A.,
  - ω. 4 .
- The fauna of British India -Oligo.

# **ELECTIVE PAPER IIIF**

# BIOPESTICIDE & BIOFERTILIZER 4 Credits

**Objectives:** The aim of this course is to introduce the students to the role of bio-pesticides and bio-fertilizers in enhancing the fertility of soil. The students also learn about the large scale production of bio-fertilizers and bio-pesticides and their mechanism of action and application.

**Outcomes:** By the end of the course, the student will be able to gain knowledge about their commercialization.

**Unit I:** Biofertilizers – Definition, kinds, microbes as biofertilizers, Symbiotic associates – Rhizobium taxonomy, Physiology, Host cell – Rhizobium interactions, inoculants and mass cultivation.

**Unit II:** Frankia woodland and Actinornizal nitrogen fixing plants and its host plants, characteristics, identification, cultural method and maintenance of Azospi-rillum, Azotobacter, Azolla and anabaena.

**Unit III:** Mycorrhiza - VAM association, types, occurrence, Collection, isolation and inoculum production.

**Unit IV:** Large scale production of biofertilizer, Organic farming Carrier materials, general outline of microbes as fertilizers, Rhizosphere effect microbial products influencing plant growth.

**Unit V:** Biopesticides – Definition, kinds and commerce of biopesticide, Bacillus thuringiensis, insect viruses and entomopathogenic fungi – its characteristics, physiology, mechanism of action and application.

- 1. Subba Rao, N.S. 2000 Soil Microbiology. Oxford and IBH Publishing Co. Ltd.
- 2. Verma A and Hock B. 1995. Mycorrhiza.
- 3. Yaacovokan, 1994 Axospirillum, CBC press.
- 4. Wicklow, D.T. and B.E. Soderstrom. 1997, Environmental and microbial relationships. Springer.

# **BSc Microbiology**

#### **Course Overview**

Microbiology is one of the fascinating and dynamic sciences. It is constantly being evolved and more information is being added in continuation with the existing literature including all the microbiological techniques being rapidly modified and refined. Microbiologists and other scientists employ the scientific method to understand natural phenomena. It provides a blend of traditional and contemporary knowledge of microbiological science to meet the pedagogical needs of all students pursuing masters' in Microbiology. The Master degree course covers the studies of microorganisms, their effect on human, environment, society etc., the applied aspects and branches of microbiology. The course is career oriented and precisely towards entrepreneurship after successful completion of the course.
# BSc Microbiology Examination Scheme

	SEMESTER I					
	Study Components and Code	Paper	Hrs/ week	Deemed to be University E		
Part				Dur. in Hours	CIA	Theory/ Exam
Ι	Part I	English I	6	3	25	75
II	Part II	English I/Kannada I	6	3	25	75
III	Core Paper I	Fundamentals of Micro- biology	4	3	25	75
	Core Practical I		4	3	25	75
	Allied I	Basics of Biostatistics	3	3	25	50
	Allied Practical I		3			
IV	Environmental Stud- ies	Environmental Studies	2	2	25	25
Т	Part I	English II		3	25	75
TT	Part II	English II/Kannada II	6	3	25	75
	Core paper II	Microhial Diversity	4	3	25	75
	Core Practical II		4	3	25	75
	Allied II	Principle of Biochemis-	3	3	25	50
	Allied Practical I & II		3	3	25	25
		I	SEMES			
Ι	Part I	English III	6	3	25	75
II	Part II	English III/Kannada III	6	3	25	75
III	Core Paper III	Microbial Physiology	4	3	25	75
	Core Paper IV	Microbial Genetics	4	3	25	75
	Core Practical III		4	3	25	75
	Allied III	Bioinformatics	3	3	25	50
	Allied Practical III		3			
IV	Skill based I	Basics of Computers	3	3	25	75
			SEMES	TER IV		
Ι	Part I	English IV	6	3	25	75
II	Part II	English IV/Kannada IV	6	3	25	75
III	Core Paper V	Microbial Metabolism and Technology	4	3	25	75
	Core Practical IV		4	3	25	75
	Allied IV	Fundamentals of Nano- technology	3	3	25	50

	Allied Practical III & IV		3	3	25	25
IV	Skill based II	Tissue Culture	3	3	25	75
			SEMES	FER V		
III	Core paper VI	Principles of Immunol- ogy	4	3	25	75
	Core paper VII	Recombinant DNA Technology	4	3	25	75
	Core Paper VIII	Medical Microbiology	4	3	25	75
	Core Practical V		4	3	25	75
	Elective I		4	3	25	75
IV	Skill based subject III	Advanced Instrumenta- tion Techniques	3	3	25	75
			SEMEST	ER VI		
III	Core Paper IX	Environmental and Ag- ricultural Microbiology	4	3	25	75
	Core Paper X	Food, Dairy and Indus- trial Microbiology	4	3	25	75
	Core practical VI		4	3	25	75
	Elective II		4	3	25	75
	Elective III		4	3	25	75
V	Extension activities					
Tota	( Semester I to VI)					

50	2
100	4

# SEMESTER I

# PART I. ENGLISH I

**Capitatives** These courses are designed to develop the communication and vocabulary skills in the students

**Watcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession 100 4

**Unit I.** Passages 1 to 5. 100 4

**100it II. 24** Correct Use of Nouns and Correct Use of Pronouns

100 4 **Unit III.** Correct Use of Adjectives and Correct use of the Verb

100 4

Unit IV. Roots (A to F) 600 24

Unit V. Roots (G to N)

₩ART II. ENGLISH I

1000it I. Passages 1 to 5

**Whit III**. Poems: "When in Disgrace" by Shakespeare; "Daffodils" by William Word-Sourth; "Obituary" by A K Ramanujan

100 4 **Unit III.** Prose: The Ultimate Safari" by Nadine Gordimer and "The Gift of the Magi" by O Henry 550 22

**3500 IV. 140**s: "Because I Could Not Stop for Death" by Emily Dickenson; "After Apple Picking" by Robert Frost and "Sonnet – The Lotus" by Toru Dutt.

**Unit V.** Prose: "The Face on the Wall" by E V Lucas and "Kabuliwala" by Rabindranath Tagore

### ಮೊದಲನೇ ಸೆಮಿಸ್ಟರ್ ಪತ್ರಿಕೆ – 1 : ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 1

ಭಾಗ – 1 ಪದ್ಯಗಳ ಓದು ಮತ್ತು ವ್ಯಾಖ್ಯಾನ

ಕನ್ನಡಿಗರ ತಾಯಿ	:	ಗೋವಿಂದ ಪೈ
รอเอี้ธ์	:	ಬಿ.ಎಂ.ಶ್ರೀಕಂಠಯ್ಯ
ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ	:	ಕುವೆಂಪು
ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ	:	ದ.ರಾ.ಬೇಂದ್ರೆ
ರಂಗವಲ್ಲಿ	:	ಮ.ತಿ.ನರಸಿಂಹಾಚಾರ್
ಸಂಬಳದ ಸಂಜೆ	:	ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
ಯಾವ ಹಾಡ ಹಾಡಲಿ	:	ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ	:	ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ
ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ	:	ನಿಸಾರ್ ಅಹಮದ್
ಅನಾಥೆ	:	ಸುಕನ್ಯಾ ಮಾರುತಿ
ನೀವೆಲ್ಲಿಯವರೋ	:	ಜಂಬಣ್ಣ ಅಮರಚಿಂತ
ಯುದ್ಧ	:	ಸವಿತಾ ನಾಗಭೂಷಣ
	ಕನ್ನಡಿಗರ ತಾಯಿ ಕಾಣಿಕೆ ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ ರಂಗವಲ್ಲಿ ಸಂಬಳದ ಸಂಜೆ ಯಾವ ಹಾಡ ಹಾಡಲಿ ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ ಅನಾಥೆ ನೀವೆಲ್ಲಿಯವರೋ ಯುದ್ಧ	ಕನ್ನಡಿಗರ ತಾಯಿ : ಕಾಣಿಕೆ : ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ : ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ : ರಂಗವಲ್ಲಿ : ಸಂಬಳದ ಸಂಜೆ : ಯಾವ ಹಾಡ ಹಾಡಲಿ : ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ : ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ : ಅನಾಥೆ : ನೀವೆಲ್ಲಿಯವರೋ : ಯುದ್ದ :

### ಭಾಗ – 2

ಗದ್ಯ ಕ	ಭಾಗ – ಪ್ರಬಂಧಗಳು		
1.	ಗರುಡಗಂಬದ ದಾಸಯ್ಯ	:	ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
2.	ದೇವರು ಮತ್ತು ಮನರ್ಜನ್ಮ	:	ಎಚ್.ನರಸಿಂಹಯ್ಯ
3.	ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ	:	ಪಿ.ಲಂಕೇಶ್
4.	ಮೊಬೈಲ್ ಠೇಂಕಾರದ ಜೇನ್ನೊಣಗಳ ಝೇಂಕಾರ :	ನಾಗೇಶ್	ಹೆಗಡೆ
5.	ಆಗಸ್ಟ್ –6 – ಶಾಂತಿದಿನ – ಶ್ರೇತಭವದನದ	:	ನೇಮಿಚಂದ್ರ
6.	– ಮುಂದೆ 20 ವರ್ಷ		-

### ಭಾಗ – 3

ಆಡಳಿತ ಕನ್ನಡ

- 1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ, ಸ್ವರೂಪ, ಲಕ್ಷಣ
- 2. ಆಡಳಿತ ಕನ್ನಡ ಬೆಳೆದು ಬಂದ ದಾರಿ (ಆಡಳಿತ ಕನ್ನಡದ ಇತಿಹಾಸ)

#### ಭಾಗ – 4

ಆಡಳಿತ ಕನ್ನಡ – ಪ್ರಾಯೋಗಿಕ ಬರವಣಿಗೆ

- 1. ಸರ್ಕಾರಿ ಪತ್ರದ ವಿವಿಧ ಅಂಗಗಳು- ಮಾದರಿಯೊಡನೆ
- 2. ವಿವಿಧ ಸರ್ಕಾರಿ ಪತ್ರಗಳು
  - ಅಧಿಕೃತ
  - ಅರೆ ಅಧಿಕೃತ
  - ಅಧಿಕೃತ ಜ್ಞಾಪನ
  - ಸುತ್ತೋಲೆ

ಭಾಗ – 5 ಪದ್ಯಗಳ ಮರುವ್ಯಾಖ್ಯಾನ ಮತ್ತು ವಿಮರ್ಶಾತ್ಮಕ ಚರ್ಚೆಗಳು

#### CORE PAPER I: FUNDAMENTALS OF MICROBIOLOGY 4 Credits

**Objectives:** This fundamental paper discusses the importance of microorganisms. The course high lights on types of microorganisms in and around humans

**Outcomes:** At the end of the course, the student has understanding on the concept of culturing microbes, sterilization techniques and estimating the number of microbes in a given .sample

**Unit I.** History and Scope of Microbiology: Spontaneous generation. Theory – conflict – Contribution of Leuvenhoek, Louis Pasteur, RobertKoch, Edward Jenner, Joseph Lister, Winogradsky, Waksman, Alexander Fleming.

**Unit II.** MicroscopyandStaining-Microscopy-Principlesandapplication-Brightfield, Dark field, Phase contrast, Fluorescence, SEM & TEM-Specimen preparation of electron microscopy –freeze etching-Staining-Stains and Staining reactions –Types of staining –simple, Differential (Grams, Spore, AFB), Capsule staining, Nuclear and Flagella staining-Albert.

**Unit III.** SterilizationandDisinfection-Principles-MethodsofSterilization-Physicalmethods- Dry heat- Moist heat, Filtration (Membrane &HEPA) - Radiation – Chemical Sterilization-Chemical agents. Mode of action-Phenol coefficient test-Sterility testing.

**Unit IV:** Culture techniques –Media preparation-Solid and Liquid-Types of Media– Crude, Semi synthetic, Synthetic, Enriched, Enrichment, Selective, Differential and Special Purpose Media (one example for each type). Anaerobic culture technique– Wright's tube, Roll tube, McIntost fields jar method-Pure culture technique-Tube dilution, Pour, Spread, Streak and Micromanipulator.

**Unit V.** Estimation of Microbes-Direct Microscopic count, Turbido-metric assay, TVC-Indirect Method -CO2 liberation. Maintenance and Preservation-Short term-Slant, Stab, Mineral oil overlay-Long term. Lyophilization, Cryopreservation, Storage in sterile soil, Storage in silica gel.

- 1. Prescott, L.MJ.P. Harley and C.A.Klein. 1995. Microbiology 2nd edition, Brown publishers.
- 2. SalleA.J.: Fundamental Principles of Bacteriology 7thedition, Tata McHill Publishing CompanyLtd.,
- 3. MichaelJ.Pelczar,Jr.E.C.S.Chan,Moel: Microbiology McGraw HillBook R.Krieg, 1986.
- 4. William claus. G.W. 1989. Understanding Microbes A Laboratory textbook for Microbiology, W.H. Freemanand Co., NewYork.
- 5. Wilson.Kand Goulding.K.H. 1986.A Biologist's Guide to Principlesand Techniquesof PracticalBiochemistry,ELBS,London.
- 6. TauroP., Kapoor, K.K.Yadav, K.S.An introduction to Microbiology first Edition, New Age International Publishers.

# CORE PRACTICAL-I 4 Credits

1. a) Laboratory safety: General rules and Regulations

b) Study of Simple and Compound Microscopes, their handling including oil immersion objective.

- 2. Preparation of Chromic acid and its use -Use and mode of action of Soaps, Detergents, Phenol, Ethyl alcohol, Iodine, Sodium Hypochlorite.
- 3. Preparations of stains and mordant- Methylene Blue, Crystal Violet, Safranine, Nigrosine, Malachite Green, Carbol fuchsin, Gram's Iodine, Lactophenol Cotton Blue.
- 4. Bacterial Staining Techniques: Simple Staining- Positive and NegativeDifferential Staining- Gram's Staining, Structural Staining- Endospore Staining
- 5. Staining and Mounting of Algae and Fungi
- 6. Studying of motility of bacteria by hanging drop method.
- 7. Micrometry: Measurements of Microorganisms using stage and ocular micrometer.
- 8. Demonstration of Laboratory Equipments: Autoclave, Pressure Cooker, Hot Air Oven, Incubator, Laminar Airflow System, Membrane Filter, Inoculation Loop and Needle, Colony Counter.
- 9. a) Cleaning and Sterilization of Glassware.
- b) Preparation Of Media: Nutrient agar medium, Potato Dextrose agar medi-

um, Czapeck Dox agar medium, Mac Conkey's agar medium, EMB agar medium.

- 10.Pure culture techniques: Serial Dilution, Pour plate, Spread plate, Streak plate, Point inoculation.
- 11.Maintenance and preservation of cultures on agar slants, overlaying with Mineral oil and stab culture.
- 12. a) Total Viable Count (TVC)- Standard Plate Count(SPC)

b) Measurement of microbial growth by cell mass using turbidometer/Photocolorimeter.

13.Study of microscopes and microbiologists mentioned in theory syllabus.

#### ALLIED PAPER I BASICS OF BIOSTATISTICS 3 Credits

**Objectives:** This course imparts the knowledge of basic statistical methods to solve problems. Students are taught to operate various statistical software packages

**Outcomes:** The students are able to appreciate the importance of statistics in research and prepare them for a career in research

**Unit I: Introduction to Statistics:** Definition and Application Of Statistics, Qualitative Data, Quantitative Data, Frequency Distribution, Cumulative Frequency, Diagrammatical Representation Of Statistical Data(Bar, Pie), Graphical Representation Of Frequency Distribution (Histogram, Frequency Polygon, Cumulative Frequency Curves).

**Unit II: Descriptive Statistics:** Measure of Central Tendency: Mean, Median, Mode, Geometric Mean (Merits and Demerits), Measure of Dispersion: Range, Standard Deviation, Variance, (Merits and Demerits), Co-Efficient of Variation.

**Unit III: Probability:** Trial, event, sure event, random event, Sample space, Definition of probability, mutually exclusive events, Independent event, Law's of Probability - simple problems, Normal probability curve.

**Unit IV: Hypothesis Testing:** Hypothesis, Types of Hypothesis, Level Of Significance, Type I and Type II Error, Standard Error, Degrees Of Freedom, Chi Square Test, Student's t Test: One Sample t Test, Paired t Test.

**Unit V: Correlation and Regression: Correlation:** Definition, Types Of Correlation, Karl Pearson's Coefficient Of Correlation, Simple Linear Regression, One Way ANOVA.

# **Reference Books:**

- 1. Fundamentals of Mathematical Statistics (2015) S.C. Gupta and V. K. Kapoor
- 2. Fundamentals of Statistics (2011): S.C. Gupta
- 3. Fundamentals of Biostatistics (2014): Veer Bala Rastogi

## COMPULSORY PAPER ENVIRONMENTAL STUDIES 2 Credits

**Objective:** The main objective of this paper is to create awareness among the students about the environment

**Outcome:** The students will have a better appreciation for the environment and become responsible citizens

**Unit I:** The Multidisciplinary nature of environmental studies: Natural Resources. Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources; b) Water resources; c) Mineral resources; d) Food

resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit II:** Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: Environmental Pollution: Air pollution; Water pollution; Soil pollution

# **Reference Books:**

- 1. Y.K. Sing: Environmental Science, New Age International Pvt, Publishers, Bangalore. 2011
- 2. Agarwal, K.C. 2011 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- 3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad. India,
- 4. Brunner R.C., 2015, Hazardous Waste Incineration, McGraw Hill Inc. 2015
- 5. Clark R.S., Marine Pollution, Clanderson Press Oxford 2015
- 6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2011, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2015
- 7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 2011
- 8. Down of Earth, Centre for Science and Environment 2011

# SEMESTER II

#### PAPER I ENGLISH II

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

Unit I. Passages 1 to 4

**Unit II:** Grammar - Correct Use of Adverbs; Correct use of Prepositions; Reported Speech

**Unit III:** Roots (O to T); Prefixes; Suffixes

**Unit IV:** Grammar - 1. Correct Use of Conjunctions; 2. Correct use of Articles; 3. Parallelism

**Unit V:** Roots (U to Z ); New Words in English

# PART II

#### **ENGLISH II**

**Unit I**: Passages 1 to 5

**Unit II**: Poems: "The Frog and The Nightingale" by Vikram Seth and "Ozymandias" by P.B Shelly

**Unit III:** Prose - 1. "Such Perfection" By R.K Narayan and 2. "Retrieved Reformation" by O" Henry

**Unit IV:** Poems; "Wild Swans at Coole" by W.B Yeats; "Lucy Grey" by William Wordsworth; "Stopping by Woods on a Snowy Evening" by Robert Frost

**Unit V:** Prose: "His Wedded Wife" by Rudyard Kipling and "The Merchant of Venice" (trial scene) by Shakespeare

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ಪತ್ರಿಕೆ - 2 : ಸವಿಸ್ತರ - ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 2 ಭಾಗ – 1 ಸವಿಸ್ತರ ಪಠ್ಯ 1. ನಾಟಕ – 1 ಕಾಕನಕೋಟೆ – ಮಾಸ್ತಿ ವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್ ಭಾಗ – 2 ಅವಿಸ್ತರ ಪಠ್ಯ 1. ಕಾದಂಬರಿ/ವೈಚಾರಿಕ ಬರಹ ಒಡಲಾಳ – ದೇವನೂರು ಮಹಾದೇವ ಭಾಗ– 3 ಆಡಳಿತ ಕನ್ನಡ – 2 1. ಅರ್ಜಿ : ಸ್ವರೂಪ ಮತ್ತು ವಿವಿಧ ಬಗೆಗಳು ಕಡತ (ಫೈಲು) 2. 5. ಕಚೇರಿ ಕಾರ್ಯವಿಧಾನ ಮತ್ತು ಕಚೇರಿ ಟಿಪ್ಪಣಿಗಳು 6. ಸರ್ಕಾರಿ ಪ್ರಕಟಣೆ, ಜಾಹೀರಾತು (ಸ್ವರೂಪ–ರಚನೆ) ಭಾಗ– 4 ಸವಿಸರ ಪಠ್ಮ ಕಾಕನಕೋಟೆ ನಾಟಕದಲ್ಲಿನ ಪಾತ್ರಗಳು, ಘಟನೆಗಳ ಸ್ರಾರಸ್ಯ ವಿವರಣೆ ಮತ್ತು ವಿಶ್ಲೇಷಣೆ ಭಾಗ – 5 ನಾಟಕ ಮತ್ತು ಕಾದಂಬರಿಗಳ ಕುರಿತು ವಿಮರ್ಶೆ ಮತ್ತು ಚರ್ಚಾತ್ಮಕ ವಿಶ್ಲೇಷಣೆ

# **CORE PAPER II**

# MICROBIAL DIVERSITY 4 Credits

**Objetives:** The students learn the important and diversified groups of microorganism in nature and their classification. They learn about the interactions within the microbial communities and between microorganism and plants and animals

**Outcomes:** At the end of the course, the student will be able to describe genomic based methods to study microbial diversity in nature and the mechanisms behind it.

**Unit I: Microbial World:** Groups of microorganisms: Prokaryotes (Cyanobacteria, Bacteria), Eukaryotes (Algae, Fungi, Protozoa). Study of ultra structure of typical Prokaryotic and eukaryotic cell- A comparative account. MICROBIAL TAX-ONOMY: General principles and nomenclature of microorganisms. Ernst Haeckel's Three Kingdom classification. Robert. H. Whittaker's Five Kingdom classification. Carl.R.Woese Three Domain System of classification.

**Unit II. Viruses:** General characteristics of viruses- Definition, size, shape and chemical composition, Properties used for classification of viruses, Isolation of viruses and importance of viruses. Study of the following viruses: Bacteriophages-Structure and replication of  $T_4$  phage. Cyanophages- Structure of LPP-1, Mycophages- Types and examples of mycoviruses, Phytophagene- Structure and Replication

of TMV,Zoophagenae- Structure and replication of Rabies virus and HIV,A brief account on viriods and prions.

**Unit III. Bacteria:** General characteristics and classification: Occurrence, shape and arrangement of bacterial cells. Ultra structure of Eubacterial cell- Cell wall (Gram positive and Gram negative), Capsule , Cell membrane, Mesosome, Cytoplasm, Ribosome, Nucleoid, Plasmids, Flagella, Pili, Fimbriae, Inclusion bodies, Endospore. Study of archeobacteria in brief. Multiplication by cell division. Classification in brief as per Bergey's Manual of systematic Bacteriology. Structure, reproduction and economic importance of following: Chlamydiae, Mycoplasma, Actinomycetes, Rickettsiae, Spirochetes and Cyanobacteria: Nostoc, Microcystis, Spirulina.

**Unit IV: Algae: O**ccurrence, Fritch's classification and general characteristics of algae. Study of thallus structure, reproduction(in brief) and economic importance of the following- Chlorella, Cosmarium, Spirogyra, Diatoms, Gracilaria.

**Unit V: Fungi and Protozoa:** Occurrence, Nutrition, Classification (Alexopolus and Mims) and General characteristics of fungi. Thallus structure, reproduction and life cycle, economic importance of the following: Rhizopus, Aspergillus, Penicillium, Saccharomyces (Yeast), Agaricus. Occurrence, Nutrition, Classification. Structure, Mode of nutrition and reproduction of the following: Paramecium, Euglena, Entamoeba, Fusarium

# **Reference Books:**

- 1. Prescott, L.MJ.P.HarleyandC.A.Klein.2015.Microbiology2nd edition. Brownpublishers.
- MichaelJ.Pelczar, Jr.E.C.S.Chan, Moel: MicrobiologyMcGrawHillBookR. Krieg, 1986
- 3. StainerR.Y.IngrahamJ.L.WheolisH.HandPainterP.R.1986. The Microbial world, 5thedition. Eagle Works Cliffs N.J. Prentica Hall.

#### CORE PRACTICAL-II 4 Credits

- 1. Study of Cyanobacteria- Nostoc, Spirulina, Microcystis.
- 2. Study of Algae- Chlorella, , Cosmarium, Diatoms, Spirogyra, Gracilaria
- 3. Study of Fungi- Aspergillus, Penicillium, Saccharomyces(yeast), Rhizopus,Agaricus.
- 4. Study of Protozoa- Entamoeba, Euglena, Paramecium.
- 5. Study of the following using photographs or slides: Lactobacillus, E.coli,Bacteroiphages, TMV, FMD Virus, Rabies Virus, Actinomycetes, Spirochetes, Chlamydiae, and Mycoplasma.

## Allied Paper II Principles of Biochemistry 3 Credits

**Objectives:** The course aims to provide exposure to the students regarding the importance of biological macromolecules and their role in reactivity of biomolecules

**Outcomes:** At the end of the course, the students have a thorough understanding on the role of biomolecules and their functions. Being an allied paper it ensures to create enough relevance with role of biomolecules in life to all disciplines like biotechnology, microbiology, food, nutrition and dietetics; as well as environmental sciences.

**Unit I:** Introduction of Cells, Water, Thermodynamics, Bonds, Photosynthesis and Respiration.

**Unit II:** Carbohydrates-Classification, Metabolism: Glycolysis, Gluconeogenesis, Krebs Cycle, Pentose Phosphate Pathway, Glyoxylate cycle. Electron Transport Chain, ATP Synthesis.

**Unit III:** Classification of Amino Acids. Peptide bond, Peptides, Protein structure, Enzymes action and classification. Nitrogen cycle. Amino acid metabolism and degradation.

**Unit IV:** Classification of lipids, Fatty acid oxidation and synthesis, Lipid bilayer, Lipid transport. Ketone bodies.

**Unit V:** Nucleic acids: Types of DNA and RNA, Central dogma of Molecular Biology, Replication, Transcription and Translation.

#### **Reference Books:**

- 1. Nelson, D. L. & Cox, M. M. Lehninger, 2013, Principles of Biochemistry. Freeman - 6th edition,
- 2. U Satyanarayana, 2013, Biochemistry. Elsevier. 5th Edition.
- 3. Berg, J. M., Tymoczko, J. L. and Stryer, L. 2011, Biochemistry. Freeman 7th edition.
- 4. Voet, D., Voet, J. G., & Pratt, C. W. 2011. Fundamentals of Biochemistry (pp. 408-409). New York: Wiley – 4th edition.
- 5. Conn, E., &Stumpf, P. 2016. Outlines of Biochemistry. John Wiley & Sons 5th edition.
- 6. West, E. S., Todd, W. R., Mascon, H. S., & Van Bruggen, J. T. 2014. Textbook of Biochemistry. Oxford and IBH Publishing - 4th Edition
- Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J. 2013. Molecular Cell Biology, Freeman - 7th edition. SEMESTER III

## PART I ENGLISH III

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Passages 1 to 5

**Unit II**: Grammar; Active and Passive Voice and Modal Auxiliaries

**Unit III**: Vocabulary; Homonyms; Figures of Speech: Alliteration, Metaphor and Simile

**Unit IV**: Grammar: Foreign expressions and Phrasal Verbs **Unit V**: Vocabulary - Figures Of Speech: Antithesis, Hyperbole, Euphemism, Iro

## PART II ENGLISH III

Unit I. Passages 1 to 5

**Unit II.** Poetry: "On His Blindness" by John Milton; "Solitary Reaper" by William Wordsworth; "The Road Not Taken" by Robert Frost

**Unit III.** Prose: "The Sniper" by Liam O' Flaherty and "A Hero" by R K Narayan

**Unit IV**: Poetry: "Where The Mind is Without Fear" by Rabindranath Tagore; "Ode To Autumn" by John Keats; "Lord Ullin's Daughter" by Thomas Campbell

**Unit V.** Prose: "The Open Window" by Saki and "The Bishop's Candlesticks" by Victor Hugo

#### ಪತ್ರಿಕೆ– 3 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 2

ಭಾಗ – 1

- ನಿಗಧಿತ ಭಾಗಗಳು: (ನಿಗಧಿತ ಪದ್ಯಗಳು ಮತ್ತು ಕಥಾಭಾಗ)
- 1. ಪಂಪನ ವಿಕ್ರಮಾರ್ಜುನ ವಿಜಯ: ದ್ವಾದಶಾಶ್ವಾಸಂ ಮಾನಸರೇನಿನ್ನೂಲು ವರ್ಷಮಂ ಬಲ್ಧಪರೇ
- 2. ಜನ್ನನ ಯಶೋಧರ ಚರಿತೆ ಮಾಡಿದುದಂ ನಾವುಣ್ಣದೆ ಪೋಕುಮೆ

#### ಭಾಗ – 2

- 1. ನಿಗದಿತ ಹತ್ತು ವಚನಗಳು ಬಸವಣ್ಣ । ಅಲ್ಲಮಪ್ರಭು । ಅಕ್ಕಮಹಾದೇವಿ । ಅಂಬಿಗರ ಚೌಡಯ್ಯ ಅಮುಗೆ ರಾಯಮ್ಮ
- ಗೀತೆಗಳು : ಸಂಗ್ರಾಹಕ ಸಂಪಾದಕ : ಮತ್ತಿಘಟ್ಟ ಕೃಷ್ಣಮೂರ್ತಿ ಜನಪದ ಗೀತೆ : ಮುಕ್ಕಣ್ಣ ಮಳೆಯ ಕರುಣಿಸು
- ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ : ಅರಣ್ಯಪರ್ವ ಸೌಗಂಧಿಕದ ಪವನನ ಬಳಿವಿಡಿದು

#### ಭಾಗ – 3

ಅವಿಸ್ತರ ಪಠ್ಯ

ಸಮಾಜಸುಧಾರಕ ಮಹಾತ್ಮಪುಲೆ (ಮೂಲ ಮರಾಠಿ ಕರ್ತೃ : ಮುರಳೀಧರ ಜಗತಾಪ) ಕನ್ನಡಕ್ಕೆ ಅನುವಾದಕರು : ಅಕಿಂಚನ – ನವಕರ್ನಾಟಕ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು.

#### ಭಾಗ – 4

- 1. ಕನ್ನಡ ಪದಕೋಶದ ಬೆಳವಣಿಗೆ
- 2. ದೇಸಿ, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು ಮತ್ತು ಪಾರಿಭಾಷಿಕ ಪದಗಳು
- 3. ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಸಂಪಾದಕರಿಗೆ ಪತ್ರ
- 4. ವರದಿ

#### ಭಾಗ – 5

- 1. ಪ್ರಾಚೀನ ಹಾಗೂ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಸಾಂಸ್ಕೃತಿಕ, ಸಾಮಾಜಿಕ ಮತ್ತು ರಾಜಕೀಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಪಠ್ಯದ ವಿಮರ್ಶೆ
- 2. ಜೀವನ ಚರಿತ್ರೆಯ ಸ್ವರೂಪ ಲಕ್ಷಣ ಹಾಗೂ ನಿಗಧಿತ ಪಠ್ಯದ ಅವಲೋಕನ.

### CORE PAPER III MICROBIAL PHYSIOLOGY 4 Credits

**Objectives:** This course teaches the students about microbial nutrition, microbial growth, enzymes involved in microbial metabolism. The course also covers bacterial photosynthesis, aerobic and anaerobic respiration and net energy gain in these processes.

**Outcomes:** The student through this course will be able to explain the principle of energy yielding and consuming reactions, various anabolic and catabolic pathways, transport systems and the mechanisms of energy conservation in microbial metabolism.

**Unit I. Microbial Nutrition:** Major nutritional types of microorganisms. Nutritional requirements of microorganisms. Uptake of nutrients- Passive diffusion, Facilitated diffusion, Active transport, Group translocation, Iron uptake.

**Unit II. Microbial Growth: G**rowth rate and generation time, growth curve, phases of growth Physico -chemical factors affecting growth: Temperature, pH, Light, salt concentration, nutrients. Synchronous growth, continuous growth and diauxic growth.

**Unit III. Enzymes:** Definition, Nomenclature, Classification, Properties, Mode and Mechanism of Enzyme action, Factors affecting enzyme action. Enzyme regulation, Inhibition: Competitive and Non-Competitive. Allosteric enzymes-their importance, Co factors and Coenzymes.

**Unit IV: Bacterial Photosynthesis:** Definition, Photosynthetic microorganisms, oxygenic and Anoxygenic types. Light as a source of energy. Photosynthesis pigments and apparatus in prokaryotes. Mechanism of Light and Dark reaction in bacteria.

**Unit V: Aerobic and Anerobic respiration:** Definition, Formation of acetyl CoA from pyruvate. TCA cycle, Electron transport chain, Oxidative phosphorylation. Definition, Breakdown of glucose to pyruvate- EMP, HMP and ED pathways. Fermentation conversion of pyruvate to ethanol and lactic acid. Efficiency of aerobic and anaerobic respiration as energy yielding processes.

- 1. Prescott, L.MJ. P.Harley and C.A.Klein 1995. Microbiology 2ndedition. Brownpublishers.
- 2. Tortora, Funke and case. Microbiology, 8th edition 2015.
- 3. Doelle.H.W.1975.BacterialMetabolism.2nd edition.AcademicPress.
- 4. Moat.A.G. J.W.Foster. 1988. Microbial physiology. 2nd edition.Springer-Verlag.
- 5. Caldwell.D.R.1995, Microbia Iphysiology and Metabolism.Wm. C Brown Publishers, England.

#### CORE PAPER IV MICROBIAL GENETICS 4 Credits

**Objectives:** Students will be taught cell division, genetic materials, their structure and types, mechanism of replication of DNA. Students gain knowledge in gene concepts and genetic code, gene expression, gene regulation and also learn about mutation.

**Outcomes**: By the end of study in this course, the student will be able to identify and distinguish genetic regulatory mechanism at different levels.

**Unit I: Chromosome Organization and Recombination Bacteria: c**hromosomes- Prokaryotic and Eukaryotic organization. Cell Division: Mitosis, Meiosis and cell cycle. Transformation, Transduction( Generalized and Specialized), Conjugation (F<sup>+</sup>, HFr, F'), genetic recombination

**Unit II. Genetic Material – Structure and Types:** Chemical basis of heredity-Evidences id DNA and RNA as genetic material (Griffith experiment, Harshey chase experiment, Avery, Mc Cleod and Mc Carty experiment). Watson and Crick model of DNA, DNA types (A,B and Z). Typs of RNA- Structure and their significance.

**Unit III. Replication of DNA:** DNA Replication- Modes( Conservative, Semi-Conservative and Dispersive modes) and mechanism(Meselson and Stahl's experiment). Models of Replication in prokaryotes( Rolling circle, theta replication)

**Unit IV. Gene Concpt and genetic Code:** Gene concept, Gene-Protein relationship: One gene-One enzyme and One gene –One polpeptide concept. Genetic code- Features, Wobble hypothesis, Evolution of genetic code.

**Unit V: Gene Expession, Regulation and Gene Mutations:** Central dogma, Gene expression- Transcription and Translation, Regulation of gene expression in prokaryotes- Lac operon, Tryptophan operon. **N**ature and types of mutation. Mutagenic agents-Physical and Chemical mutagens. Damage and Repair of DNA- Photoreactivation and SOS repair.

- 1. Gardner, E.J, Simmons, MJ & DPSnustard, 1991, Principles of Genetics, 8thedition. John Wiley & Sons.
- 2. Freifelder.S, 1987. Microbial Genetics, Jones & Bartlett, Boston.
- 3. RobertH.Tamarin.PrinciplesofGenetics, 5th edition, BrownPublishers.
- 4. Lewin.B, 1990. Genes, 6th edition, Oxford University Press.
- 5. Klug.W.S. &Cummings, MR, 1996, Essentials of Genetics, MenticsHail. New-Jersey.

# Core Practical III 4 Credits

- 1. Effect of temperature on the growth of microorganisms.
- 2. Effect of pH on the growth of microorganisms.
- 3. Effect of oxygen on the growth of microorganisms.
- 4. Effect of phenol on the growth of microorganisms.
- 5. Effect of UV radiations on the growth of microorganisms.
- 6. Effect of Heavy metals on the growth of microorganisms.
- 7. Isolation of streptomycin resistant mutant by Gradient-Plate Technique.
- 8. Demonstration of the following through models/photographs- A-DNA, B-DNA, Z-DNA, DNA replication, t-RNA, transcription, translation, transformation, transduction, conjugation.
- 9. Effect of Carbon sources on microbial growth
- 10.Measurement of cell growth by cell mass using tubidometer /photocalorimeter/ spectrophotometer
- 11. Measurement of growth by cell number using Haemocytometer
- 12.Study of mitosis ans meiosis using onion root tip.
- 13.Kunhe's Fermentation.

## ALLIED PAPER III FUNDAMENTALS OF BIOINFORMATICS 2 Credits

**Objectives:** This allied paper introduces the students to concepts in bioinformatics

**Outcomes:** The student will be able to apply basic principles of biology, computer science and mathematics to address complex biological problems

**Unit I:** Introduction and history of bioinformatics–Internet, World Wide Web, Web browser, EMBnet, NCBI. File transfer protocol.

**Unit II:** Database browsers and search engines. Introduction to MS access, making queries, Designing forms, Report design

**Unit III:** Database-Definition, DBMS, Biological Databases– FASTA, Blast, Genbank, DNA sequence data bases, Protein databases.

**Unit IV:** Entry formats, carbohydrate databases, Enzyme databases, Pathway databases. Relational data base model. Theory on RDBMS. SQL.

**Unit V:** Application aspects– gene prediction, target searching's–drug designing – E-cell, phylogenetic analysis, PERL, Chemo-informatics.

- 1. Introduction to Bioinformatics. T.K.Altwood, D.J.Parry-Smith (2014) Pearson Education.
- 2. Bioinformatics for the beginners by K. Mani & N. Vijayaraj (2015). Jaypee Publishers.
- 3. Proteomics- Pennigton & Dunn (2012). Viva books publishers, New Delhi
- 4. Bioinformatics-A practical guide to the analysis of genes & protein. 2nd Edition. Andreas, Baxevanis and Francis Ouellette.

#### SKILL BASED PAPER I BASICS OF COMPUTERS 4 Credits

**Objectives:** This is a skill-based paper that introduces the students to the basics of computer operations. The student is imparted with knowledge on both hardware and software.

**Outcomes:** The student has a better understanding on the use of computers for various applications

Unit-I: Fundamentals of Computer, MS- Office, and Operating System

**Unit-II:** Basics of HTML, HTML 5, J- Query, Database Management System

Unit-III: Basic Networking, VB- Visual Basics, Data Structure using C++

**Unit-IV:** Software Engineering, Asp.net, Computer Graphics.

Unit-V: Training on SPSS Software

#### **Reference Books:**

1. Rajib Mall, Fundamentals of Software Engineering (2015), Prentice Hall of India

### SEMESTER IV PART I ENGLISH IV

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Comprehension Passages and Poems

Unit II: Grammar: Formal Letter Writing and Report Writing

Unit III. Grammar: Story writing. Subject Verb Agreement. Essay writing

**Unit IV**: Vocabulary: Onomatopoeia and Personification

**Unit V**: Vocabulary: Pun, Role Plays and Headline English

## PART II ENGLISH IV

**Unit I**. Poetry: "Mending Wall" by Robert Frost" and "I Know Why a Caged Bird Sings" by Maya Angelou

**Unit II.** Poetry: "Ode to the West Wind" By P. B Shelly, "The Brook" by Alfred Tennyson and "This is going to hurt "by Ogden Nash

Unit: III. Prose - "An Astrologers Day" By R K Narayan and Mahatma Gandhi

Unit IV: Prose: "The Refund" by Fritz Karinthy

**Unit V: Prose:** "The Last Leaf" by O 'Henry

#### ಪತ್ರಿಕೆ – 4 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ

ಭಾಗ – 1

ಅಯ್ಯಂಗಾರ್
0
ಅಯ್ಯಂ

ಭಾಗ – 2

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ - 2 : ( 6 ಸುನೀತಗಳು)

1.	ಸಣ್ಣಸಂಗತಿ	:	ಕೆ.ಎಸ್.ನ
2.	ತವರ ಮನೆಯಿಂದ ನಾ ನಿನ್ನ ಕರೆಸಿದನೇಕೆ	:	ವಿ.ಜಿ.ಭಟ್ಟ
3.	ಸ್ಥಾವರಕ್ಕಳಿವುಂಟು	:	ಜಿ.ಎಸ್.ಎಸ್
4.	eo๋ฮd ้	:	ಚೆನ್ನವೀರ ಕಣವಿ
5.	ಅನುಭವ ಮಂಟಪ	:	ಜಿ.ಎಸ್.ಸಿದ್ದಲಿಂಗಯ್ಯ
6.	ದೈವ ಕಲಿಸುವ ಪಾಠ	:	ಕೆ.ಎಸ್.ನಿಸಾರ್ ಅಹಮದ್

ಭಾಗ -	- 3		
ಅವಿಸ್ತರ	ರ ಪಠ್ಯ– ಗದ್ಯಭಾಗ : ಕಥೆಗಳು		
1.	ಶುಕ್ರಚಾರ್ಯ	:	ಬಾಗಲೋಡಿ ದೇವರಾಯ
2.	ನಲ್ಲಿಯಲ್ಲಿ ನೀರು ಬಂತು	:	ಕೆ.ಸದಾಶಿವ
3.	ನಿರಾಕರಣೆ	:	ವೀಣಾ ಶಾಂತೇಶ್ವರ
4.	ಬುರ್ಖಾ	:	ಫಕೀರ್ ಮಹಮ್ಮದ್ ಕಟ್ಟಾಡಿ
5.	ಅಲ್ಲಿ ಆ ಅಳು ಈಗಲೂ	:	ಮೊಗಳ್ಳಿ ಗಣೇಶ್

#### ಭಾಗ – 4 ಆಡಳಿತ ಕನ್ನಡ

- 1. ಗಾದೆಯ ಸ್ವರೂಪ, ಬಳಕೆ ಮತ್ತು ವಿಸ್ತರಣೆ
- 2. ವಾಕ್ಯ ರಚನೆ : ಸರಳ ವಾಕ್ಯಗಳು, ಸಂಕೀರ್ಣ ವಾಕ್ಯಗಳು
- 3. ಪ್ರಬಂಧದ ಸಾಮಾನ್ಯ ಸ್ವರೂಪ, ರಚನೆ
- 4. ಸಂಕ್ಷೇಪನ ಲೇಖನ ಸ್ವರೂಪ, ಪ್ರಾಯೋಗಿಕ ರಚನೆ

#### ಭಾಗ – 5

- 1. ನವೋದಯ ಸಾಹಿತ್ಯದ ಕಾಲಘಟ್ಟದಲ್ಲಿ ಸುನೀತ ಪ್ರಕಾರದ ಹುಟ್ಟು ಬೆಳವಣಿಗೆ.
- 2. ಸುನೀತದ ಲಕ್ಷಣ, ಸ್ವರೂಪಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಾವ್ಯಭಾಗದ ವಿವೇಚನೆ
- 3. ಧಾರ್ಮಿಕ, ರಾಜಕೀಯ ಹಾಗೂ ಸಾಮಾಜಿಕತೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಥಾಭಾಗದ ವಿಮರ್ಶೆ

#### CORE PAPER V MICROBIAL METABOLISM AND TECHNOLOGY 4 Credits

**Objectives:** The students in the course learn the biochemical aspects of metabolic pathways of microorganisms. They also learn the application of microbial cells in bioremediation and mineral recovery.

**Outcomes:** At the end of the course, the students will be able to appreciate the aspects of microbial metabolism and their application in industries.

**Unit I. Nitrogen Metabolism:** Biological nitrogen fixation- Symbiotic and asymbiotic nitrogen fixation, Nodule formation, Bacteriods, Leghaemoglobin, Mechanism of Nitrogen fixatrion, Amino acid synthesis, Proteolysis.

**Unit II. Lipid Metabolism:** Biosynthesis of fatty acids, Acyl carrier protein, Fatty acid synthetase complex, Degradation of fatty acids, Oxidation of fatty acids.

**Unit III. Immobilized Microbial Cells:** Immobilization of Microbial Cell- Carrier-Binding method, Cross linking method, Entrapping method. Characteristics of Immobilized Microbial Cells- Oxidorectase reaction, Transferase reaction, Hydrolase reaction.

**Unit IV: Microbial Bioremediation:** Xenobiotics, Bioremediation mechanisms, Essential characteristics of Microbes for Bioremediation, Microbes involved in Bioremediation, Metabolic process involved in Bioremediation. Bioremediation Techniques: *In situ* and *Ex situ* remediation techniques. Bioremediation of specific pollutants: Oil spills (Crude oil, petroleum), Polychlorinated biphenyls (PCBs).

**Unit V: Microbial Mining:** Microorganisms in mineral recovery. Recovery of copper by Dump Leaching and Uranium Leaching.

- 1. Microbial Technology, Volume I and II by Peppler, Perimn, Elsevier, Academic Press.
- 2. Microbial Bioremediation, P. Rajendran, P. Gunasekaran, MJP Publishers.
- 3. Microbial Biotechnology, Alagawadi, Krishnaraj, Narosa Publication.
- 4. Environmental Biotechnology, Geetha Bali, Ramamurthi, APH Publishing.
- 5. Microbial Biotechnology-Fundamentals of Applied Microbiology, Alexander N. Glazer, Hiroshi Nikaido, W H Freeman & Company.

# Core Practical IV 4 Credits

- 1. Demonstration of acid and gas production from carbohydrates- Lactose fermentation.Starch hydrolysis test.Gelatin hydrolysis test.
- 2. Catalase activity test.
- 3. Ammonification: Demonstration of ammonification using nitrogenous organic compounds.
- 4. Nitrification: Demonstration of nitrification by enzymatic conversion of ammonia to nitrate by soil microorganisms.
- 5. Denitrification: Demonstration of denitrification by the reduction of nitrates to nitrogen gas.
- 6. Immobilization of yeast invertase.

## ALLIED PAPER IV FUNDAMENTAL OF NANOTECHNOLOGY 3 Credits

**Objectives**: This is an interdisciplinary and emerging area. The students are taught the basics of nanotechnology and their applications

**Outcomes**: The course introduces the students to the new and novel applications to solve biomedical problems through nanotechnology

**Unit I: Introduction to Nanotechnology:** Fundamentals of Nanoscience, History of Nanoscience and Nanotechnology, Properties of nanomaterials - optical, electronic and magnetic properties.

**Unit II: Classes of Nanomaterials:** Metal and Semiconductor Nanomaterials, Quantum Dots, Carbon Nanotubes and Bucky balls. Organic based nanomaterials – liposomes, dendrimers, and micelles. Inorganic based nanomaterials – gold/ silver nanoparticles and magnetic nanoparticles

**Unit III:** Synthesis Nanomaterials: Top down method of synthesis - Nanolithography, CVD, ball milling. Bottom-up method of synthesis – Colloidal synthesis, solgel method, Self-assembly methods.

**Unit IV: Physicochemical characterization on Nanomaterials:** Optical method (UV - Vis absorption and fluorescence spectroscopy), electron microscopy techniques (SEM and TEM).

**Unit V: Applications of Nanotechnology:** Environmental applications – Green nanotechnology- green synthesis of nanoparticles, Nanomaterials as solution to environmental problems. Pesticide removal in ground water using nanoparticles. Industrial applications of nanotechnology; Cosmetic Industry – nanoparticles based sunscreens, antimicrobial creams. Food Industry – Antimicrobial coatings and smart packaging. Nanomaterial based food supplements. Textile Industry – Stain resistant textiles, self-cleaning and flame resistant textiles. Agriculture sector – Crop improvement, Nano-fertilizers. Nanomedicine – Cancer Nanotherapy and Point of care diagnostics

- 1. A.Nabok, "Organic and Inorganic Nanostructures", Artech House, 2011
- 2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2017
- 3. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2012.

# ALLIED PRACTICAL-III & IV: BIOINFORMATICS & NANOTECHNOLOGY

- 1. To calculate the absorption coefficient from UV-Vis spectrometer
- 2. To do the peak analysis of IR transmission spectrum using FTIR spectrometer
- 3. Trace out the emission spectra for UV excited luminescent sample
- 4. To determine particle size of nanoparticles using UV spectra
- 5. To synthesis nanoparticles using colloidal method

### SKILL BASED PAPER II Tissue Culture 4 Credits

**Objectives:** This skill based course introduces the students to the concepts in tissue culture applicable to plants and animals

**Outcomes:** They are also taught their applications in biotechnology and biochemical research. This course introduces the students to explore entrepreneurial avenues in this field

**Unit I:** Types of Plant Cultures: Introduction to organogenesis, Production of haploid plants and their applications, Ovary and ovule culture, In vitro pollination and fertilization, Pollen culture, Anther culture, Embryo culture: History and methodology, Embryo rescue after wide hybridization, Applications, Somatic embryogenesis, Endosperm culture and production of triploids, Single cell suspension cultures and bioreactors, Protoplast isolation and culture, Meristem, axillary and shoot tip culture: micro propagation

**Unit II:** Applications of Plant Tissue Culture, Soma clonal variation and applications, Somatic Hybridization and its applications, Virus free plants, Germplasm conservation, Synthetic seeds, DNA transformation methods in plants and applications, Hairy root culture, Secondary metabolite production

**Unit III:** Types of Animal cell culture, Organ culture, Primary explant cultures, and Established cell lines, commonly used cell lines: origin and characteristics, Growth kinetics and cells in culture, Bioreactors for large scale culture of cells, Cell fusion, Transplantation of cultured cells (Grafting)

**Unit IV:** Applications of animal cell culture, Limitations and ethical issues, Transfection and transgenic animals, Expressing cloned products in animal cells, The need to express in animal cells, Over production and processing of chosen protein, Production of special secondary metabolites/ products (insulin, growth hormone, interferon, t – plasminogen activator, factor VIII etc), Production of vaccines using animal cell culture, Production of monoclonal antibodies and its applications, In vitro fertilization

Unit V: Study of laboratory equipment's, Stocks and Media preparation, Steril-

ization techniques in plant tissue culture, Explant selection, treatment and inoculation, Subculture of initiated cultures, Acclimatization of cultures, Extraction of proteins from plants and its estimation, Extraction of DNA/RNA from plants and its estimation, Estimation of peroxidase activity in plants, Study of  $\beta$  – amylase enzyme from germinated pulses, Demonstration of animal cell culture technique.

- 1. Plant Tissue Culture, Theory and Practice, Rev Ed S. S. Bhojwani, M.K. Razdan. (2015)
- 2. Animal Cell Culture and Technology- M Butler. (2014)
- 3. Freshney's Culture of Animal Cells. (2011).

## **SEMESTER V**

#### CORE PAPER VI PRINCIPLES OF IMMUNOLOGY 4 Credits

**Objectives:** This course gives an overview on the immune system including organs, cells and receptors. The students learns about molecular basis of antigen recognition, hypersensitivity reaction, antigen-antibody reactions

**Outcomes:** The course develops in the student an appreciation for principles of immunology and its applications in treating human diseases.

**Unit I.** Introduction- Historical Development in Immunology. Immunity- Humoral and Cell mediated response, Primary and Secondary immune response. Cells involved in immune response. Innate and Acquired immunity. Mechanism of defence.

**Unit II.** Antigen-Types and Classifications. Antibody- Structure, Types, Prpperties and their biological functions, poly clonal sera, Monoclonal antibody. Primary and Secondary lymphoid organs- Thymus, Bone marrow, Lymph nodes and Spleen. Lymphocytes traffic and regulation, CD molecules.

**Unit III.** Hematopoiesis and development of B and T lymphocytes. Immunoglobulin Gene expression B cell and T cell activation. MHC molecules. Response of B cells to antigens. Plasma cells, Memory cells.

**Unit IV.** Complement- activation and regulation. Cytokines- structure and functions, Interferon and interleukins. Immuno regulation: Tolerance, Suppression, Auto immunity and Hypersensitivity reactions. Primary and Secondary Immunidefienciey disorders.

**Unit V.** Transplantation, HLA Typing: Mechanism of Graft rejection. Tumor immunology. Immuno surveillance- mechanisms. Antigen- Antibody reactions. Immunodiffusion and Immunoelectrophoresis. Principle and Applications of RIA, ELISA, Fluorescent Antibody techniques.

- 1. Kuby.J.1997.Immunology,W.H.Freeman, NY
- 2. Tizard, IR 1998. Immunology AnIntroduction, Second edition.W.B.Saunders, Philadelphia.
- 3. Roitt,IM. 1991.EssentialsofImmunology, 7th edition. Blackwell Scientific Publications.
- 4. NandhiniShetti, 1993. Immunology, IntroductoryText Book.NewAge. International Limited

#### CORE PAPER VII RECOMBINANT DNA TECHNOLOGY 4 Credits

**Objectives:** This course teaches RDNA technology techniques and their application in the field of genetic engineering. They learn about plasmids, vectors and gain knowledge on the construction of cDNA libraries

**Outcomes:** Student of this course has knowledge on gene manipulation, gene expression, etc which prepares them for further studies in the area of genetic engineering.

**Unit I.** Gene manipulation: Definition and Application, Restriction Enzymes, Discovery, Types and Mode of Action, Ligases and Methylases.

**Unit II.** Isolation-Purification of DNA. (Chromosomal and Plasmid), Isolation and Purification of RNA, Chemical Synthesis of DNA. Genomic Library and cDNALibrary.

**Unit III.** Vectors–Plasmid based Vectors-Natural (PSC101, PSF2124, PMB1), Artificial–pBR322&pUCConstruction: Phage basedVectors-(Lamda) phage Vectors and ts Derivatives. Hybrid Vectors-Phagemid, Phasmid and Cosmid, BAC and YAC.

**Unit IV.** Gene Transfer Techniques: Physical–BiolisticMethod, Chemical- Calcium chloride and DEAE Methods, Biological invitro package method -Screeningand Selectionof recombinants. Direct Methods, Selection by complementation, Marker inactivation. Methods, IndirectMethods, immunological and GeneticMethods

**Unit V.** PCR, Blotting (Southern, Western, Northen) Techniques, RFLPand Application, RAPD and Application, Microarray.

- 1. Old.RWand Primbrose, 1995. Principles of Gene Manipulation, 5thedition. Blackwell Scientific Publication, Boston.
- 2. Winnecker, E.D, 1987-Fromgenetoclones, IntroductiontoGeneTechnology, CH Publication.
- 3. T.ABrown1995, 3rd Edition, An introductiontoGeneCloning, Champman and Hall.
- 4. GlickB.R and Pasternak J.J, 1994. Molecular Biotechnology.Principles and Applications of recombinant DNA, ASM Press,Washington.

#### CORE PAPER VIII MEDICAL MICROBIOLOGY 4 Credits

**Objectives:** This interdisciplinary course teaches the students interactions between human and microbes, diseases caused by microbes. They learn about culture, collection, handling and transport of clinical samples. They also learn about diagnosis of various microbial diseases.

**Outcomes:** At the end of the course students will be able to identify diseases and understand the treatment plan.

**Unit I. Infection and Pathogensis:** History and Development of Medical Microbiology Microbial flora of human body. Infection- Types of infection, modes of transmission, Portal of entry. Pathogenesis- Virulence- Attenuation and exaltation with an example each.

**Unit II. Clinical Microbiology and Nosocomial Infections:** Laboratory specimens: a) Collection of samples. b) Handling and Transport of laboratory specimens. **Nosocomial infections:** Common types, Sources and Reservoirs of Hospital acquired infections. Microorganisms causing Nosocomial infections.

**Unit III. Bacterial and Vral Diseases of Human Beings:** Pathogen- Morphology, cultural characteristics, classification, pathogenesis, clinical symptoms, laboratory diagnosis, epidemiology, prophylaxis and treatment of the following human diseases: Bacterial- Typhoid, Syphilis, Tuberculosis, and Anthrax. Viral- Poliomyelitis, Hepatitis, AIDS

**Unit IV. Fungal and Protozoan Dieeases of Human Beings:** Pathogen- Morphology, cultural characteristics, classification, pathogenesis, clinical symptoms, laboratory Diagnosis, epidemiology, prophylaxis and treatment of the following human diseases: Fungal- Dermatomycosis, Candidiasis. Protozoan- Malaria, Amoebic dysentery.

**Unit V. Antibiotics and Antibiotic resistance:** General characteristics and types of antibiotics. Characteristics and mode of action of Penicillin, Streptomycin and Chloramphenicol. Drug Resistence- Mechanism, Multiple Drug Resistance (MDR).

- 1. Mackieand Mc Catney, 1994, Medical Microbiology NoI and II. Churchill Livingston, 14th Edition.
- 2. Ananthanarayanan R and CK Jayaram Panicker, 1994, Textbook of microbiology Orient Longman.
- 3. Chakraborty P 1995, AText book of microbiology, New Central Book Agency Pvt Ltd. Calcutta.
- 4. Bailey and Scotts, 1994, Diagnostic Microbiology, 9th edition, Baron and Fine gold CVM Publications.
- 5. Jawetz EMelnic JL and Adel berg EA. 1998. Review of Medical Microbiology. Lange Medical Publications, USA.

# CORE PRACTICAL V 4 Credits

- 1. Differential WBC count in a given human blood sample.
- 2. Antibiotic sensitivity test.
- 3. Determination of blood groups and Rh factor.
- 4. Determination of precipitation reaction- Ouchterlony method.
- 5. Detection of typhoid by WIDAL test and syphilis by RPR test.
- 6. Isolation of DNA.
- 7. PCR Demo
- 8. Study of the following: Immunotechniques: ELISA, RIA. Human pathogens: Mycobacterium tuberculosis, Salmonella typhi, Bacillus anthracis, Treponema pallidum, Hepatitis virus, Candida albicans, Plasmodium, Entamoeba histolytica.

#### ELECTIVE PAPER I A WATER & WASTEWATER TREATMENT 4 Credits

**Objectives:** The purpose of this course is to introduce the concept of water and waste water treatment techniques. The students learn about water resources, water treatment methods, waste water treatment and techniques for water treatment.

**Outcomes:** At the end of the course, the student is well aware on the principles involved in proper treatment of both water and waste water.

**Unit I:** Introduction: Water resources, Water demand, total requirement of water for a town & city, per captia demand, factors affecting water demand, variations in demand, design periods.

**Unit II:** Water Treatment: Importance & necessity for planned water supply, Need for water treatment, Methods for purification of water – Screening, primary settling tank, filtration & disinfection.

**Unit III:** Wastewater: Types of wastewater, Wastewater Characteristics- Physical, Chemical & Biological, Importance of improved wastewater characterization, Wastewater flow rates and constituent loadings

**Unit IV:** Wastewater Treatment: Introduction, Methods of treating domestic waste water – Screening, Primary Settling tank, Grit Chamber, Secondary & tertiary treatment of wastewater.

**Unit V:** Advanced Water & Wastewater treatment: Water – Softening, Adsorption, Desalination, Reverse Osmosis, and Wastewater - Floatation, Nitrogen & Phosphorus removal, Water Quality Standards, Guidelines for effluent discharge.

- 1. Fair, G.M., Geyer J.C and Okun, (2014) "Water and Waste water engineering" Vol II, John Wiley Publications.
- 2. Weber W.J., (2015) "Physico Chemical Processes for Water Quality Control".

- 3. Peavy, H.S., Rowe and Tchobonoglous, G., 2012, "Environmental Engineering", McGraw Hill
- 4. Raju, B.S.N., (2015), "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt. Co. Ltd., New Delhi.
- 5. Benefield R.D., and Randal C.W., 2011, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey.
- 6. Metcalf and Eddy Inc., (2013), "Wastewater Engineering Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

#### ELECTIVE PAPER I B ENVIRONMENTAL BIOTECHNOLOGY 4 Credits

**Objectives:** The students are introduced to the biological revolutions in this field. They are taught about the microbial populations, bio-geo magnification. They learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.

**Outcomes:** The students will be able to demonstrate the use of environmental science principle in solving various environmental problems

**Unit I:** Biochemistry: Introduction, Lipids, sugars, polysaccharides, nucleotides, RNA, DNA, amino acids, proteins, hybrid biochemical, hierarchy of cellular organisms.

**Unit II:** Multiple interacting microbial populations: Neutralism, mutualism, commensalism and amensalism. Classification of interaction between two species. Bio concentration, bio/ geo-magnification.

**Unit III:** Biotechnology: Introduction to microbial biotechnology, uses of enzymes and biomass production, isolation and purification of enzyme engineering, Sewage treatment using microbial systems, nitrogen fixing and pollutant degrading genes, biocontrol agents.

**Unit IV:** Uses of microbes: Isolating and culturing of microorganisms, production of organic compounds like, ethanol and acetone by microbial fermentation, production of enzymes by microorganism.

**Unit V:** Specific biotechnological applications to pollution control, restoration of degraded lands, free-cells and immobilized cell technology for wastewater treatment aerobic and anaerobic digestion, biogas from wastes. Bio techniques for air pollution abatement and odor control.

- 1. Biochemical Engineering and Fundamentals– Bailey and Ollis, (2014), Mc-Graw Hill International Edition.
- 2. A Textbook of Biotechnology– Dubey, R.C., S. Chand and Co., New Delhi. (2014).
- 3. Elements of Biotechnology Gupta, P.K., (2011), Rastogi Publications, Meerut.
- 4. Chemistry for Environmental Engineering and Science– Sawyer, C.N., Mc Carty, P.L., and Parkin, G.F., (2013),5th Edition, TMH Edition, Tata Mc Graw

Hill Co. Ltd.,New Delhi.

- 5. Environmental Molecular Biology, Paul. A, Rochelle, 2011. Horizon Press.
- 6. Industrial and Environmental Biotechnology, Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, 2016. Horizon Press.
- 7. Waste water engineering treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi. 2014
- 8. Environmental Chemistry (2015), AK. De, Wiley Eastern Ltd, New Delhi.

#### ELECTIVE PAPER IC AGRICULTURAL BIOTECHNOLOGY 4 Credits

**Objectives**: This course teaches the students approaches to manipulate and improve plant yield, throws light on transgenic plants. They are introduced to the concept of utilizing plants for production of vaccines and production of bio fertilizers.

**Outcomes:** These students will be able to understand the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use

**Unit I:** Biotechnology in agriculture, growth and historical perspective of agricultural biotechnology. Agriculture biotechnology –Risks and applications.

**Unit II:** Transgenic plants resistance to biotic and abiotic stress. Transgenic plants in crop improvement. Advantages and applications of transgenic plants.

**Unit III:** Transgenic plants in quality modifications–Starch, Oil, Protein, Golden Rice, Suppression of endogenous gene, Male sterilization.

**Unit IV:** Plants derived vaccines, flower modification and color, targeting transgenic product to chloroplast and mitochondria.

**Unit V:** Biofertilizers, importance of Bio-fertilizers in agriculture (Rhizobium, Azotobacter, mycorrhiza, Actinorhiza) advantages and current status, vermi culture, composting, current practices and production of biofertilizers.

#### **Reference Books:**

- 1. Biotechnology fundamental and application (4th edition, 2011) by S.S.Purohit.
- 2. Plant Biotechnology (2011) by B.D.Singh
- 3. Plants, Genes and agriculture (2012) by Maartein, J.Christpeels, David E.Sdava.
- 4. Crop Biotechnology (2015) by P.R.Yadav, Rajiv Tyagi.
- 5. Plant Biotechnology (2013) by Chawla.Gendel,
- 6. Steven M. Agricultural Bioethics: Implications of Agricultural Biotechnology (2015).

### ELECTIVE PAPER I D MEDICAL BIOTECHNOLOGY 4 Credits

**Objectives:** The students are introduced to the biological revolutions in this field. They are taught the role of biotechnology in the worldwide market. They learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.

**Outcomes:** The students will be able to demonstrate the use of biotechnology in solving various medical problems.

**Unit I:** Tools of Medical Biotechnology–Biotechnological revolutions- Genomics, combinatorial chemistry, insight into basic biology-Areas of application, Diagnosis and prediction of disorders Limits and approaches.

**Unit II:** Role of biotechnology in health care. World-wide market and work in medical biotechnology. Vaccine production-New developments.

**Unit III:** Biosensors in clinical diagnosis, chiral technology, monoclonal antibodies for immunotherapy.

**Unit IV:** Recent developments in medical biotechnology–Pharm for human proteins and neutraceuticals. Tissue engineering and therapeutic cloning, Application of nanotechnology in biomedical sciences- Green nano substances.

**Unit V:** Gene delivery, Drug delivery. Nanotechnology in replacing defective cells.

#### Reference Books:

- 1. Fundamentals of medical biotechnology (2015) by Aparna Rajagopalan, Ukaaz publications.
- 2. Medical biotechnology (2014) by S.N.Jogdand, Himalaya publications.

#### ELECTIVE PAPER I FERMENTATION TECHNOLOGY 4 Credits

**Objectives:** The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine.

**Outcomes:** At the end of the course, the student will have a better appreciation for the role of microbes in industry using technology.

**Unit I:** Introduction to fermentation technology, History of fermentation, fermentation processes, Biomass, enzymes and metabolites. Process components. Batch, continuous and fed-batch cultures. Fermenting media formulation: Carbon and nitrogen sources. Oxygen requirements and process optimization.

**Unit II:** Design and operation of Fermenters, Basic concepts for selection of a reactor, packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor.

**Unit III:** Microbial culture selection for fermentation processes: Isolation, maintenance and development of microorganisms. Starter utilization. Immobilization of biocatalysts: kinetics effects. Inactivation kinetics.

**Unit IV:** Bio-catalysis: in non-conventional media (biphasic; organic; ionic liquids; supercritical fluids).

**Unit V:** Down Stream processing. Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis. Bioprocess economics. Bio product regulation. General fermentation economics.

## **Reference Books**:

- 1. Biely, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (2014) Megraw Hills. Rehm, H.J. and Reed G (ed), Biotechnology, Vol 1-2, Verlag chemie.
- 2. Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (2014) Pergamon Press.
- 3. Pirt, S.J. Principles of Microbial and Cell Cultivation (2014). Blackwell Scientific Publication, London.
- 4. Moo-young M. Comprehensive Biotechnology (2015). Vol. 1-4 Pergamum Press Oxford.

#### ELECTIVE PAPER 1 MICROBIAL CULTURE TECHNIQUE 4 Credits

**Objectives:** The students in this course learn different types of pure culture techniques, preservation of pure culture and culture collection centers. This course also introduces the students to the different types of media and teaches about isolation of strain and improvement.

**Outcomes:** By the end of the course, the students will be able to isolate cultures in pure form and preserve cultures for further use in research studies

**Unit I:** Microbial culture techniques: Definition, Pure culture and axenic culture, Principles and methods of obtaining pure culture, Preservation of pure culture, culture collection centers.

**Unit II:** Definition and Significance of Streak plate, Pour plate, Spread plate. Single Cell isolation. Cultivation of Bacteria: Media used, Properties of good culture media.

**Unit III:** Definition, Concept, Use and Types of different culture media. Synthetic, Non- synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium. Buffers in culture medium.

**Unit IV:** Measurement and Kinetics of Microbial Growth, Scale up of microbial process.

**Unit V:** Isolation of microbial products. Strain isolation and improvement. Applications of Microbial technology.

# **Reference Books**:

- 1. Bisen P.S., Varma K: Handbook of Microbiology (2011). CBS Publishers and Distributors, Delhi.
- 2. Dubey R.C. and D.K. Maheshwary, A textbook of Microbiology (2012). S Chand and Co. New Delhi.
- 3. Pelczar Michael J., Jr., E.C.S. Chan, Elements of Microbiology (2012). Mc-Graw, Hill International. Book Company, New Delhi.
- 4. Pelczar Michael J., Jr. E.C.S Chan, Noel R.Krieg: Microbiology: Concepts and applications (2011). McGraw Hill Inc.
- 5. Pelczar Michael J., Reid R.D. and Chan E.C.S.: Microbiology (2014). Tata McGraw hill publishing Co. Ltd., New Delhi.

# SKILL BASED PAPER III ADVANCE INSTRUMENTATION TECHNIQUES 4 Credits

**Objectives:** This skill based course will teach the students the various instrumentations that are used in the analytical laboratories. This course covers both fundamental and applications of the instruments that are routinely used for the characterization of biomolecules

**Outcomes:** At the end of the course, the student has the basic knowledge on the theory, operation and function of analytical instruments.

**Unit I:** NMR spectroscopy: Principle, Instrumentation, Solvents used in NMR, NMR signals in various compounds, Chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, <sup>13</sup>C NMR, 1D and 2D NMR, NOESY and COSY techniques, Applications of NMR spectroscopy.

**Unit II:** Mass Spectroscopy: Principle, Instrumentation of Mass Spectroscopy, Types of ionization like electron impact, chemical, field, FAB and MALDI, Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Tandem Mass Instruments, Applications of Mass spectroscopy

**Unit III**: Chromatography: Principle, Apparatus / Instrumentation, Chromatographic parameters, Factors involved, Endpoint determination and Applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) GC-MS g) High Performance Liquid chromatography h) LC-MS i) High Performance Thin Layer chromatography k) Super critical fluid chromatography l) Affinity chromatography.

**Unit IV**: Electrophoresis: Principle, Instrumentation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis.

**Unit V**: X ray Crystallography: Production of X rays, Different X ray methods, Braggs law, Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction.

- 1. Bisen P.S., Varma K: Handbook of Microbiology CBS Publishers and Distributors, Delhi
- 2. 4Pelczar Michael J., Jr. E.C.S Chan, Noel R.Krieg: Microbiology: Concepts and applications-McGraw Hill Inc.
- 3. Pelczar Michael J., Reid R.D. and Chan E.C.S.: Microbiology, Tata McGraw hill publishing Co. Ltd., New Delhi.
- 4. 3. Powar C.B. and Daginawala H.F.: General microbiology Vol I and II Himalaya publishing house Bombay.
- 5. 4. Prescott L.M., Harley J.P., and Klein Donald A.: Microbiology, W.M.C., Brown publishers
## SEMESTER VI

#### CORE PAPER IX ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY 4 Credits

**Objectives:** The aim of this course is to impart knowledge in soil microflora, plant pathology and post-harvest pathology. The students learn about water and waste water microbiology, air microbiology and their treatment processes.

**Outcomes:** The student at the end of the course would have gained knowledge about microbial associations with soil and plants, plant diseases and their management, water treatment techniques and solid waste recycling.

**Unit I.** Distribution of microorganism: Microbial communities in soil –factors. influencing the microbial density in soil-zymogenous and autochthonous flora in Soil-Microbialassociations–symbioticprotocooperation, ammensalism, Commensalism, syntropism, parasitism and predation with suitable examples.

**Unit II.** Microbial decomposition; cellulose, Hemicellulose, lignin, pectin and chitin. Factors influencing degradation, acetateutilization, bioconversion of organic wastes-sugarcane wastes. Coir pith composition. Composting, principles and Applications-conversion process Microorganisms in the decomposition of organic matter-carboncycle-nitrogen Cycle- nitrogenfixingmicroorganisms-root nodule bacteria –nonsymbiotic Nitrogen fixers-biofertilizers in agriculture-Rhizobium and phosphate solubilisers, Mycorrhizial association-phosphorous cycle.

**Unit III.** Plant Pathology: Introduction. Historical Developments, Classification of Plant diseases, Principles of infection and Spread of Diseases.Plant Diseases: Study of Symptoms, etiology, epidemiology and management of following diseases: Bean Mosaic, Sandal Spike, Citrus Canker, Downey Mildew of grapes, Powdery Mildew of Mulberry, Blast of Rice, Tikka Disease of Groundnut,Red Rot of Sugarcane. Brief account on post harvest pathology.

**Unit IV.** Water microbiology, algae, phytoplankton. Eutrophication-watertreatment. Primary, secondary and tertiary .Drinking water-Portability-MPN technique. Waste water microbiology: Introduction, sewage treatment-septic tank, Municipal sewage treatment- primary, secondary and tertiary, solid waste recycling.

**Unit V.** Aero-microbiology. Aaerosol, droplet nuclei, air pollution-sources (Microbiological), air quality analysis, air sampling devices.

- 1. Atlas R.M and Bartha.R 1992, Microbial Ecology .Fundamental and application. 3rdedition. Bengamin and Cummings.
- 2. Alexander. AM 1987. Introduction to Soil Microbiology. 5th edition. JohnWiley and sons,
- 3. Mitchell R 1974, Introduction to Environmental Microbiology, Prentice Gall Inc., Englewood Cliffs.
- 4. Rangasamy,G and D J Bagyaraj, Agricultural microbiology,AsiaPublishing House,NewDelhi.
- 5. Rheinhermer, G.1986. Aquatic Microbiology, John Wiley and Sons, NY.
- 6. Grant.W.D.P.E.Long.1981EnvironmentalMicrobiology, Thomson Litho Ltd.

### CORE PAPER X FOOD, DAIRY AND INDUSTRIAL MICROBIOLOGY 4 Credits

**Objectives:** Students in this course will learn about microbes in food, spoilage of food and preservation techniques of food. Through this course, they also learn about microbiology of milk, fermented diary products, industrially important microorganisms and process of industrial production of alcohol, beer, wine, SCP and mushrooms.

**Outcomes:** At the end of the course, the student will be able to use the preservation techniques for food and use this experience to be employed as quality control experts.

**Unit I. Microbes in Food, Spoilage, pf Food and preservation of Food:** Important organisms in food (Bacteria, mold and yeast) and sources of food contamination. Spoilage of food: cereals, vegetables, fruits, egg, milk, canned foods. Techniques of food preservation: Physical methods: Pasteurization, High temperature and Canning.Low temperature: Refrigeration, Freezing (slow and quick freezing). Drying: Solar drying, Rotary drum drying, Spray drying. Radiation: UV-rays, Cathode rays, Gamma rays. Chemical methods: Chemical preservatives: Propionates, Benzoates, Sorbates, Nitrates and Nitites, Sulphur dioxide and sulphites, sugar and salt, wood smoke.

Unit II. Food Borne Infection, Intoxications and Quality Control: Bacterial intoxication:

Staphylococcal intoxication, Botulism. Bacterial infection: Salmonellosis. Origin of mycotoxins. A general account on Aflatoxin. Microbiology of the food product: HACCP. A brief account on FDA.

**Unit III. Dairy Microbiology:** Microbiology of raw milk, Hygienic milk production, Biochemical changes in milk. Methods to detect microbial contamination in milk by SPC, Reductase test. Starter culture- Salient features, Types of starter culture. Fermented dairy products- Types, preparation and importance of the following: cheese, yoghurt, condensed milk, whole and skimmed milk powder, ice-cream. Methods of preservation of milk and milk products.

**Unit IV. Industrial Microbiology:** Microorganisms of industrial importance, stock culture-working stock and primary stock, strain improvement, Fermentation media- Raw materials-Molasses, Corn steep liquor, sulphite waste liquor, whey and growth factors, precursors, buffers, inhibitors and antifoam agents. Design of typical fermentor, Fermentation processes, Fermentation types, Down stream processing.

**Unit V. Industrial Prodution:** Ethyl alcohol, Beer, SCP-Spirulina production, lactic acid, amylase. Mushroom-Types, cultivation and its nutritional value. Oyster mushroom (Bag method), White button mushroom(Tray method).

- 1. Frazier. W.C and D.C. Westhoff. 1978. FoodMicrobiology. 3rd ed. Tata Macgraw Hill Publishing Co., New Delhi.
- 2. Jay, J.M .1991 . Modern Food Microbiology 4th edition, Van Nostra and RainhokddCo.

- 3. Fundamentals of Dairy Microbiology byPrajapati. 2015
- 4. Dairy Microbiologyby Robinson R.K.1990 Volume II and I. Elsevier Applied science, London.

## CORE PRACTICAL VI 4 Credits

- 1. Isolation and enumeration of bacteria and fungi from soil by serial dilution method.
- 2. Isolation of air borne microorganisms by petriplate exposure method
- 3. Standard analysis of water for detection of coliforms- Determination of MPN.
- 4. IMViC reactions
- 5. Study of Anabaena in azolla.
- 6. Study of VAM fungi.
- 7. Isolation and identification of Rhizobium from root nodules.
- 8. Study of antagonism reactions between microorganisms.
- 9. Biological indicators of water pollution
- 10.H2S strip test
- 11.Estimation of total solids in sewage.
- 12.Study of plant diseases: Bean Mosaic, Sandal Spike, Citrus Canker, Downey Mildew of grapes, Blast of Rice, Tikka Disease of Groundnut.
- 13.Gram staining of Citrus canker.
- 14.Isolation and identification of bacteria and fungi from spoiled fruits and vegetables.
- 15.Isolation and identification of Aspergillus and other fungi on groundnut and other cereals by Blotter's method.
- 16.Quantitative examination of bacteria in raw and pasteurized milk by SPC method
- 17.Determination of microbial quality of milk by- a) MBRT test. b)Rezazurin test. c) Clot On Boiling (COB) test
- 18.Detection of boiled and unboiled milk by Turbidity test.
- 19. Estimation of percentage of alcohol in a given sample by Specific Gravity Bottle method.
- 20.Preparation of wine from grapes.
- 21.Study of the following : Cheese, yoghurt, canned foods, Spray drier, Rotary drum drier, Molasses, Whey, Wine, Antifoam agents, Sulphite waste liquor, Beer, Penicillin, Western blotting, southern blotting and Northern blotting.
- 22.Study of the following using charts or photographs: Air sampling equipments/Photographs: Anderson sampler, Membrane filter, Rotorod sampler, Liquid impingement (Bead bubbler). Study of water purification process: Baffles, Flocculator, Clarifier, Sand filter, Backwash, Chlorinometer.

#### ELECTIVE PAPER IIA ECOTOURISM 4 Credits

**Objectives:** This course introduces the students to the basics of healthy promotion of tourism with environmental perspective.

**Outcomes:** At the end of the course, the student will be able to apply these learning to practical use.

**Unit I:** Tourism: Concepts, Definition and Historical development of tourism. Distinction between Tourist-Traveler-Visitor-Excursionist. Types and Forms of Tourism; Tourist system Nature, characteristic. Components of tourism and its characteristics.

**Unit II:** Domestic and International tourism: Domestic tourism: features, pattern of growth, profile. International tourism: Generating and Destination regions. Pattern of growth and Profile.

**Unit III:** Places of interest of ecotourism: Wildlife Sanctuaries (Bharatpur Bird Sanctuary, Biligiri Rangaswamy Temple), National Parks (Jim Corbett Tiger Reserve, Kanha NP, Kaziranga NP, Gir NP,) and Biospehere reserves in India (Nilgiri BR, Sunderbans BR, Seshachalam Hills BR). Hill Stations: Study of Hill Station attractions and their environs with case studies of Mussoorie, Nainital, Munnar and Ooty. Beaches: Beaches in Goa, Kerala, Orissa. Islands: Andman Nicobar & Lakshdvip islands.

**Unit IV:** Tourism Impacts: Positive and Negative Impacts of Tourism: Socio - cultural, Economic, Environmental and Political. Factors affecting ecotourism impacts, Ecotourism as a tool for sustainable development.

**Unit V:** Ecotourism related organizations: History, objectives and role of UNWTO, WTTC, TAAI, IATO, IATA, and ITC in promoting ecotourism, Role of environmental education in ecotourism.

- 1. Bhatia. Tourism Development, 2000, New Delhi, India
- 2. Seth: Tourism Management, 2000, Pune, India
- 3. Kaul: Dynamics of Tourism, 1999, New Delhi, India.
- 4. Mill and Morrison The Tourism system an Introductory Text (2000)) Prentice Hall
- 5. Cooper, Fletcher, Tourism, Principles and practices (1999) Pitman
- 6. Burkart and Medlik Tourism, Past, Present and Future (1981) Heinemenn, ELBS.
- 7. P.S. Gill, Dynamices of Tourism (4 Vols) Anmol Publication.
- 8. P.C. Sinha, Tourism Management. Anmol Publication. 1999

#### ELECTIVE PAPER IIB ENVIRONMENTAL TOXICOLOGY 4 Credits

**Objectives:** This course is designed to impart the basics in toxicological aspects that effect the environment. The students learn about toxicology, chemical carcinogenesis, epidemiology and environmental health.

**Outcome:** The outcome of this course is to provide the necessary knowledge to the students to understand the basic toxicological aspects

**Unit I:** Basic Definitions and Terminology, Concept, Importance and the Dose–Response Relationship, Factors Influencing Dose–Response Curves, Descriptive Toxicology: Testing Adverse Effects of Chemicals and Generating Dose–Response Data, Extrapolation of Animal Test Data to Human Exposure

**Unit II:** Toxicology and safety, Transfer across Membrane Barriers, Absorption, Distribution, and Elimination of Toxic Agents, Sites of Biotransformation, Biotransformation Reactions, Hematotoxicity: Basic Concepts and Background, Direct Toxicological Effects of CO<sub>2</sub>, Inorganic Nitrates/Nitrites and Chlorate Salts.

**Unit III:** Chemical Carcinogenesis: Terminology of Cancer, Carcinogenesis by Chemicals, Molecular Aspects of Carcinogenesis, Testing Chemicals for Carcinogenic Activity, Occupational Carcinogens, Cancer and Our Environment

**Unit IV:** Properties and Effects of Metals: Classification of Metals, Speciation of Metals, Pharmacokinetics of Metals, Toxicity of Metals, Sources of Metal Exposure, Toxicology of Selected Metals-Fe, Hg, Pb, Ar, Cr, Properties and Effects of Pesticides: Organophosphate and Carbamate Insecticides

**Unit V:** Epidemiology and Environmental Health: History of Epidemiology, Epidemiologic Causation, Types of Epidemiologic Studies: Advantages and Disadvantages, Exposure, Disease and Human Health Effects, Measurement of Disease or Exposure Frequency

- 1. Phillip L. Williams, Robert C. James, Stephen M. Roberts, Principles of Toxicology-Environmental and Industrial Applications (2nd Edn.), AWiley-Interscience Publication, Johnwiley & Sons, Inc. 2014.
- 2. John H. Duffus, Howard G. J. Worth, Fundamental Toxicology, Published by The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF, UK. 2015

#### ELECTIVE PAPER IIC BIO- PROCESSING & SEPARATION 4 Credits

**Objectives:** The course introduces the analytical methods used in separation science. They learn about various analytical techniques that are routinely used for separation of biomolecules and their components

**Outcomes:** The course teaches students the advantages of separation science as applied to biotechnology.

**Unit I. Classification of Bioproducts:** Small molecules, Macromolecules-Proteins, Nucleic acids and nucleotide, Polysaccharides, Engineering analysis.

**Unit II: Analytical methods:** Biological activity, Analysis of purity-Electrophoresis, HPLC, HPLC-Mass Spectrophotometric assay, Microbiological assays.

**Unit III: Cell lysis and Flocculation:** Cell structure- Prokaryotic cells, Eukaryotic cells, Cell lysis- Chemical and mechanical methods, Flocculation- Electric double layer, Flocculation rate.

**Unit IV:** Filtration: Filtration principles- Conventional and crossflow filtration, filter media and equipment, membrane fouling, scaleup and design of filtration system. **Unit V:** Equation of motion, Equilibrium sedimentation, Sedimentation coefficient, Equivalent time, Production centrifuge, Ultracentrifugation. Sedimentation at low acceleration, partitioning equilibria, Phase separation, Countercurrent stage calculation, scale up and design of extractors.

#### **Reference Books:**

- 1. Bioseparation and Bioprocessing: A Handbook, 2 Volume Set (2012). Ganapathy Subramanian (Editor) Wiley publishers.
- 2. Introduction to Environmental Biotechnology- A K Chatterji (2011). Edition 2nd.

#### ELECTIVE PAPER IID BIOTECHNOLOGICAL APPLICATION IN WASTE WATER MANAGEMENT 4 Credits

**Objectives:** The objective of this course is to introduce the students to the role of biotechnology in waste water management. The students learn about role of microbes in biodegradation, bioremediation and composting.

**Outcomes:** At the end of the course will be able to understand the treatment processes of waste water and also the knowledge of production of biogas.

**Unit I:** Historical introduction to water and waste water environment. Domestic and industrial waste water flow rate and characteristics. Design of waste water network, waste water treatment process. Biotechnology in Environment & Biodiversity: Waste Water Treatment, Biodegradation, Bioremediation, composting, Solid waste Management, chemical degradation, heavy Metals. Biofuel- Biodiesel, Biogas, Ethanol.

**Unit II:** Microorganisms & Agriculture – Microorganisms in Agricultural Waste water treatment, vermiculture, Microbial pesticides.

**Unit III:** Environmental Management – Concept of health and sanitation, environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases, health hazards due to pesticide and metal pollution, waste treatment, solid waste management.

**Unit IV:** Secondary classification, advanced treatment process – Granular media filtration, Absorption. Chemical treatment, air stripping and ammonia removal. Waste water disinfectant. Diffuses from waste water – plume flow, design. Treatment of waste water in Food processing, Paper, Sugar and Leather industry.

**Unit V:** Soil Tests, Percolation test, Aerobic digestion, anaerobic digestion, composting, Sludge disposal.

## **Reference Books:**

- 1. Purohit by Introduction to Biotechnology- Brown, Campbell, Priest- Panima Publications (2011)
- 2. Biotechnology by U Satyanarayana- New Age publications (2011).
- 3. Biotechnology by B.D. Singh, Kalyani Publications (2012)
- Biotechnology: Expanding Horizone- B.D. Singh- Kalyani Publications. (2012)
- 5. A Text book of Biotechnology R.C. Dubey- S. Chand (2014).
- 6. Advances in Biotechnology- S.N. Jogd and- Himalaya Publication (2012).

## ELECTIVE PAPER IIE BIOETHICS & BIOSAFETY 4 Credits

**Objectives:** This course is an introduction to the students on the ethical aspects of conducting research and safety aspects to be adhered in a research setting. This course also introduces the students to effective management of available resources and footprint of research activities.

**Outcomes:** At the end of the course, the student would have gained sufficient knowledge to act as a responsible scientist and environmentally conscious.

**Unit I:** Definition of ethics and Bioethics: Ethics in Biotechnology (positive and negative effects with classical examples–Rice with Vitamin A. No till Agriculture, cotton without insecticide, reduced need for fertilizer, biological pest control, slow ripening fruits and controlled ripening, fast growing trees and fishes.

**Unit II:** Awareness education on genetically engineered organism.-Transgene instability, gene flow, resistance/ tolerance of target organism, increase weed less ness, risks and uncertainty associated with biotechnology.

**Unit III:** Containment levels and their impact on Environment- Containment-definition, types of containment, summary of recommended Biosafety levels for infectious agents, detail checklist–premises and lab equipment, Animal facilities, environment.

**Unit IV:** Gene technology laboratory. GLP and Bioethics-introduction, national Good Laboratory Practices (GLP), the GLP authority functions, Good Laboratory Practices-necessity, aspiration and responsibility.

**Unit V:** Ethics in clinical trials and Good Clinical Practices (GCP) Definition of clinical trials and GCP, general information about clinical trials, need to conduct clinical trials, faces of clinical trials, institutional set ups for conducting clinical trials, ethics in clinical biotechnology.

- 1. Safety Assessment by Thomas, J.A., Fuch, R.L. (2002), AcademicPress.
- 2. Biological safety Principles and practices) by Fleming, D.A., Hunt, D.L., (2000).ASM Press.
- 3. Biotechnology- A comprehensive treatise. Legal economic and ethical dimensions VCH. Bioethics by Ben Mepham, Oxford University Press, 2005.
- 4. Bioethics & Biosafety by R Rallapalli & GeethaBali, APH publication, 2007
- 5. Bioethics& Biosaftey By Sateesh Mk (2008), IkPublishers

6. Biosafety And Bioethics Rajmohan Joshi Publishers

## ELECTIVE PAPER IIF MICROBIAL DISEASES CONTROL 4 Credits

**Objectives**: This course is designed to impart knowledge on infectious disease epidemiology, investigating the outbreak and the role of public health laboratories in disease surveillance. The students are taught on the various infectious diseases, mode of transmission and different evaluation and control strategies. The students would also be able to appreciate behavioral changes in HIV patients, blood safety and immigrant health.

**Outcomes:** The student at the end of the course will be able to gain knowledge about vaccination, screening of various diseases and modeling infectious disease data.

**Unit I:** General principles of infectious disease epidemiology, including: Principles of Infectious Diseases; Outbreak Investigation.

**Unit II:** Role of the Public Health Laboratory; Disease Surveillance; Modeling Infectious Disease Data, Principles of Screening and Screening Tests.

**Unit III:** Major infectious diseases and modes of transmission, including: Food borne Illness; Zoonotic Diseases; Tuberculosis; Influenza; Vector-Borne Diseases; Malaria; Other Parasitic Diseases; HIV/AIDS; Sexually Transmitted Diseases; Viral Hepatitis; Antibiotic Resistant Bacteria.

**Unit IV:** Different control and evaluation strategies for infectious diseases, including: Vaccination; Nosocomial Infections.

**Unit V:** Behavior Change and HIV/STDs; Blood Safety; Immigrant and Refugee Health; International Research in Resource Poor Settings; Critical Reading of Medical Literature.

## **Reference Books**:

- 1. "Infectious Disease Epidemiology", Second Edition, edited by Kenrad Nelson and Carolyn Williams. Jones and Bartlett, 2007.
- 2. "Control of Communicable Diseases Manual", 19th Edition, edited by David L. Heymann. American Public Health Association, 2008
- 3. Riegelman, R. (2010) Public Health 101: Healthy People Healthy Populations, Sudbury, Massachusetts: Jones and Bartlett Publishers.
- 4. Pfizer. (2006). Milestones in Public Health: Accomplishments in Public Health over the Last 100 Years. New York: Pfizer Global Pharmaceuticals
- 5. Pfizer. (2003). Advancing healthy populations: The Pfizer guide to careers in public health. New York: Pfizer Global Pharmaceuticals
- 6. Pfizer. (2007). Moments in Leadership: Case studies in Public health Policy and Practice. New York: Pfizer Global Pharmaceuticals

#### ELECTIVE PAPER IIIA SOLID WASTE MANAGEMENT 4 Credits

**Objectives:** This course introduces the students on the various methods available for solid waste management. The course covers topics on composition, properties, transportation, separation, transfer and recycling of solid waste.

**Outcomes:** At the end of the course, the students will be able to appreciate all the aspects involved in solid waste creation, minimization and complete environmentally safe method of their disposal.

**Unit I:** Introduction: Definition, Sources – household, street, demolition, construction. Composition and Properties of Municipal Solid Wastes. Legislation and its impact.

**Unit II:** Engineering principles: Generation rates, Collection, waste handling and separation, storage and processing at the source.

**Unit III:** Collection, transfer and transportation: Types, equipment, personnel requirements, analysis & collection system, collection routes, types of transfer stations, transport means and methods.

**Unit IV:** Separation, transformation and recycling: Unit operations for separation and processing, size reduction, separation, density separation, fundamentals of

thermal processing – combustion, pyrolysis, gasification, energy recovery system.

**Unit V:** Biological and chemical conversion technologies: Principles, Aerobic &, anaerobic composting and energy recovery. Incineration - Process, Types, Heat Recovery, Incineration Products, Air Pollution Control

## **Reference Books:**

- 1. George Tchobanaglous, Hilary Theissen and Samuel A. Vigil, (2013), Integrated Solid Waste Management: Engineering Principles and Management Issues–, McGraw-Hill Science Engineering.
- 2. Bhide and Sundaresan (2015), Solid Waste Management in Developing Countries, Indian National Scientific Documentation Centre. New Delhi.
- 3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (2016), Environmental Engineering, McGraw Hill Publishing company, New York.
- 4. Sincero, A.P., and Sincero, G.A., (2018), Environmental Engineering A Design Approach, Prentice- Hall of India Pvt. Ltd., New Delhi.
- 5. Sasikumar K and Krishna S. G., (2016), Solid Waste Management, PHI Learning Pvt. Ltd., New Delhi.

#### ELECTIVE PAPER IIIB HYDROLOGY 4 Credits

**Objectives:** This course introduces the students on the various methods available for solid waste management. The course covers topics on composition, properties, transportation, separation, transfer and recycling of solid waste.

**Outcomes:** At the end of the course, the students will be able to appreciate all the aspects involved in solid waste creation, minimization and complete environmentally safe method of their disposal.

**Unit I: Introduction:** Definition of hydrology, Importance of hydrology, Practical applications of hydrology, Global water availability, Water resource availability in India's. Water consumption pattern, Impacts of over exploitation of water.

**Unit II: Ground water hydrology and well hydraulics:** Scope and importance of ground water hydrology. Water bearing geological formations, Rock properties affecting ground water, ground water basins, springs, Aquifers - Definition, Types of aquifer, properties of aquifer, Vertical distribution of ground water.

**Unit III: Hydrological cycle** *Precipitation:* forms and types of precipitation. Measurement of precipitation (recording and non-recording type), Annual rainfall in India, Evaporation: Definition, Process, factors affecting evaporation, transpiration evapo-transpiration, reducing evaporation from water bodies, Infiltration: Definition, factors affecting infiltration, infiltration capacity, Measurement of infiltration.

**Unit IV: Water resources management:** Introduction. Water wealth in India, Importance of river basins, Saline water intrusion, water resources projects in India, advantages and disadvantages of water resources projects, Water resources management in India with special reference to Karnataka.

**Unit V: Rainwater harvesting:** Definition, need, objectives, elements and types of rainwater harvesting, Methods of ground water recharge, Advantage and limitations of rain water harvesting, Case study of rain water harvesting, traditional rain water harvesting.

## **Reference Books:**

- 1. Subramanya K, (2008), Engineering Hydrology Tata McGraw Hill, New Delhi.
- 2. Jaya Rami Reddy, (2005) A Text Book of Hydrology, Laxmi Publications, New Delhi.
- 3. H.M. Raghunath, (2009), Hydrology-Principle analysis and design, Wiley Eastern Publication, New Delhi.
- 4. Ven Te Chow, Larry W. Mays, David R. Maidment, (1988), Hand Book of Hydrology, McGraw Hill.

#### ELECTIVE PAPER IIIC: GENOMICS & PROTEOMICS 4 Credits

**Objectives:** This course aims to provide the knowledge and practical skills of functional genomics and proteomics. The course also teaches the techniques used in functional genomics such as microarrays, NGST, mRNA expression and miRNA expression.

**Outcomes:** By the end of the course, students will have the necessary learning to radically advance our understanding of life and transform medicine

**Unit I:** Introduction to genome data bases-data base search-Algorithm issues in databases search- sequence database search- FASTA-BLAST-Types of genomic data bases and uses: Polymorphic markers, Cytogenic Maps, LINE, SINE-Amino acid substitution matrices PAM and BLOSUM.

**Unit II:** Gene Therapy: Concept and Principles of Gene Therapy. Principles of gene Expression-Genome Mapping-physical and genetic mapping techniques, Human Genome Project- Genomes of other organisms. Shotgun DNA sequencing – Sequence assembly-Gene predictions-Molecular prediction with DNA strings.

**Unit III:** Genomic resources, Gene structure and DNA sequences. EST comparison, gene hunting. Expression analysis SAGE, cDNA library, ORF prediction, Microarray –DNA sequencing and sequence alignment: RFLP, SNP, RAPD, Application of Comparative Genomics.

**Unit IV:** Protein database: CATH, SCOP, FSSP, SARF, MM. Protein structure and comparison, Blocks, Class, Domain, Fold, Profile, Motif and PSSM.

**Unit V:** Structural Proteomics: Experimental Techniques for Protein Structure Elucidation, X-ray Crystallography, 2-D Electrophoresis- Sample preparation, pH gradient-MALDI-TOF, Electro plot, Protein Microarrays and Bio-separation.

Metabolomics: Understanding the Metabolic Pathways of Microbes, metabolic pathway databases - KEGG. Structure prediction, active site determination, neural networks. Protein–protein interaction, protein–DNA interaction. Enzyme Substrate interaction. Applications of Proteomics: Plant breeding and Biomedical.

## **Reference Books:**

1. Introduction to bioinformatics by Dr. Mani and Dr. Vijayaraj. Wiley Publisher

- Bioinformatics by Parry and Smith (2005). Wiley Publisher
   Bioinformatics by David Mount. Wiley Publisher
   Genomes 3 by T. A.Brown. Wiley Publisher
   Proteomics-Pennigton & Dunn (2002) Viva books publishers, New Delhi

#### ELECTIVE PAPER-IIID INDUSTRIAL BIOTECHNOLOGY 4 Credits

**Objectives:** The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine

**Outcomes:** At the end of the course, the student will have a better appreciation for the role of biotechnology in industry using microbes

**Unit I:** Fermenter-batch and continuous fermenter, general design of a stirred tank fermenter, sterilization and maintenance of sterile conditions.

**Unit II:** Preparation of inoculums, Types of fermentation- solid state fermentation- tray and drum, and submerged fermentation-batch and fed batch, Media used for industrial fermentation.

**Unit III:** Microbial production and product recovery-Alcoholic beverage-wine and beer. Production of vinegar from alcohol, production of vitamin- B12, production of organic acid-lactic acid and glutamate.

**Unit IV:** Fermented dairy products-microorganisms involved in fermentation, yogurt, curds, sour cream, cheese paneer, pickles, idly, single cell protein.

**Unit V:** Starting an Enterprise: Entrepreneur, business idea, Management, Marketing and Financial Planning.

#### **Reference Books:**

- 1. Industrial Microbiology, Prescot and Dunn, 2015
- 2. Biochemical Engineering and Biotechnology Handbook, Atkinson, Band Marituna, F., the Nature Press, Macmillan Publisher 2015.
- 3. Biochemical Engineering Fundamentals (2014), Bailey&Olis.MGH.
- Text book of Biotechnology– Plant Biotechnology and industrial biotechnology (2014) by S.B. Sullia, G. SivaKumarSwami, P.A. Sastry-United publishers

#### ELECTIVE PAPER IIIE VERMICULTURE TECHNOLOGY 4 Credits

**Objectives:** This course teaches about earthworm biology and role of earthworm in soil in association with microorganism. They also study the different earthworm species used in vermi-compost production and importance of vermicompost in organic farming.

**Outcomes:** At the end of the course, the students will be able to use vermicomposting as a tool for solid waste management, organic farming and be able to set up small-scale industry.

Unit I: Soil biota -Earthworms -Ecological classification of earth worms as Epiga-

mic. Introduction to earthworm biology -physical and chemical effects of earth worms on soils.

**Unit II:** Role of earthworms in soil -classification of earthworms based on ecological strategies- Burrowing activity of earthworms- Drilospheres -Microorganisms and their relationship with earthworms.

**Unit III:** Composting -anaerobic composting, aerobic composting, types of composting, vermi-compost- earthworm species used in vermi-compost production - endemic species, exotic species.

**Unit IV:** Vermi compost -setting up vermi compost quality N, P, K, C, N, Microbial quality applications –vermi-culture –vermi wash - role of vermi compost in organic farming - its quality and advantages over chemical inputs.

**Unit V:** Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions. Vermicomposting as a tool for solid waste management - a small scale industry.

## Reference Books:

- 1. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
- 2. Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London Ismail, S.A., 1997, Vermicology: The Biology Earth worm Orient Longman
- 3. Kale Radha, D 1998. Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore.
- 4. Satchell, J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London Stephenson J, 1923. The fauna of British India -Oligo.

#### ELECTIVE PAPER IIIF BIOPESTICIDE & BIOFERTILIZER 4 Credits

**Objectives:** The aim of this course is to introduce the students to the role of bio-pesticides and bio-fertilizers in enhancing the fertility of soil. The students also learn about the large scale production of bio-fertilizers and bio-pesticides and their mechanism of action and application.

**Outcomes:** By the end of the course, the student will be able to gain knowledge about their commercialization.

**Unit I:** Biofertilizers – Definition, kinds, microbes as biofertilizers, Symbiotic associates – Rhizobium taxonomy, Physiology, Host cell – Rhizobium interactions, inoculants and mass cultivation.

**Unit II:** Frankia woodland and Actinornizal nitrogen fixing plants and its host plants, characteristics, identification, cultural method and maintenance of Azospi-rillum, Azotobacter, Azolla and anabaena.

**Unit III:** Mycorrhiza - VAM association, types, occurrence, Collection, isolation and inoculum production.

**Unit IV:** Large scale production of biofertilizer, Organic farming Carrier materials, general outline of microbes as fertilizers, Rhizosphere effect microbial products influencing plant growth.

**Unit V:** Biopesticides – Definition, kinds and commerce of biopesticide, Bacillus thuringiensis, insect viruses and entomopathogenic fungi – its characteristics, physiology, mechanism of action and application.

#### **Reference Books**:

- 1. Subba Rao, N.S. 2000 Soil Microbiology. Oxford and IBH Publishing Co. Ltd.
- 2. Verma A and Hock B. 1995. Mycorrhiza.
- 3. Yaacovokan, 1994 Axospirillum, CBC press.
- 4. Wicklow, D.T. and B.E. Soderstrom. 1997, Environmental and microbial relationships. Springer.

## **BSc Biotechnology**

#### **Course Overview**

BSc Biotechnology course will enable students to learn about the science behind biotechnology while also looking at how to succeed in a career in the industry. The students will also learn about how new start-up biotechnology companies are created, as well as about exploring the market potential of products and processes, creating business plans and raising money from venture capitalists. Our group enterprise projects, which involve close collaboration with entrepreneurs, provide a great opportunity for you to stand out from other graduates. This course is designed to produce graduates who have a solid understanding of science, technology and business management, along with the entrepreneurial skills required to exploit technological advances within a competitive environment.

The BSc in Biotechnology aspires to develop professionals with competencies to search for solutions into society's problems, by applying the knowledge and skills of Biotechnology. The curriculum includes the development of skills for the appropriate administration of modern technologies applied to life in the production of consumer goods. The Program promotes the development of responsible decision-making related to the environment, bioethics, health and industry. Graduates of this Program will be able to work in the field of biotechnology or in research

## Syllabus

## PART I. ENGLISH I

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

Unit I. Passages 1 to 5.

**Unit II. 2**: Correct Use of Nouns and Correct Use of Pronouns

**Unit III.** Correct Use of Adjectives and Correct use of the Verb

**Unit IV**. Roots (A to F)

**Unit V**. Roots (G to N)

#### PART II. ENGLISH I

**Unit I**. Passages 1 to 5

**Unit II**. Poems: "When in Disgrace" by Shakespeare; "Daffodils" by William Wordsworth; "Obituary" by A K Ramanujan

**Unit III.** Prose: The Ultimate Safari" by Nadine Gordimer and "The Gift of the Magi" by O 'Henry

**Unit IV.** Poems: "Because I Could Not Stop for Death" by Emily Dickenson; "After Apple Picking" by Robert Frost and "Sonnet – The Lotus" by Toru Dutt.

**Unit V.** Prose: "The Face on the Wall" by E V Lucas and "Kabuliwala" by Rabindranath Tagore

#### ಮೊದಲನೇ ಸೆಮಿಸ್ಟರ್ ಪತ್ರಿಕೆ – 1 : ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 1

ಭಾಗ – 1 ಪದ್ಯಗಳ ಓದು ಮತ್ತು ವ್ಯಾಖ್ಯಾನ

ಕನ್ನಡಿಗರ ತಾಯಿ	:	ಗೋವಿಂದ ಪೈ
รอเอี้ธ์	:	ಬಿ.ಎಂ.ಶ್ರೀಕಂಠಯ್ಯ
ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ	:	ಕುವೆಂಪು
ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ	:	ದ.ರಾ.ಬೇಂದ್ರೆ
ರಂಗವಲ್ಲಿ	:	ಮ.ತಿ.ನರಸಿಂಹಾಚಾರ್
ಸಂಬಳದ ಸಂಜೆ	:	ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
ಯಾವ ಹಾಡ ಹಾಡಲಿ	:	ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ	:	ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ
ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ	:	ನಿಸಾರ್ ಅಹಮದ್
ಅನಾಥೆ	:	ಸುಕನ್ಯಾ ಮಾರುತಿ
ನೀವೆಲ್ಲಿಯವರೋ	:	ಜಂಬಣ್ಣ ಅಮರಚಿಂತ
ಯುದ್ಧ	:	ಸವಿತಾ ನಾಗಭೂಷಣ
	ಕನ್ನಡಿಗರ ತಾಯಿ ಕಾಣಿಕೆ ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ ರಂಗವಲ್ಲಿ ಸಂಬಳದ ಸಂಜೆ ಯಾವ ಹಾಡ ಹಾಡಲಿ ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ ಅನಾಥೆ ನೀವೆಲ್ಲಿಯವರೋ ಯುದ್ಧ	ಕನ್ನಡಿಗರ ತಾಯಿ : ಕಾಣಿಕೆ : ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ : ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ : ರಂಗವಲ್ಲಿ : ಸಂಬಳದ ಸಂಜೆ : ಯಾವ ಹಾಡ ಹಾಡಲಿ : ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ : ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ : ಅನಾಥೆ : ನೀವೆಲ್ಲಿಯವರೋ : ಯುದ್ಧ :

## ಭಾಗ – 2

ಗದ್ಯ	ಭಾಗ – ಪ್ರಬಂಧಗಳು		
1.	ಗರುಡಗಂಬದ ದಾಸಯ್ಯ	:	ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
2.	ದೇವರು ಮತ್ತು ಪುನರ್ಜನ್ಮ	:	ಎಚ್.ನರಸಿಂಹಯ್ಯ
3.	ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ	:	ಪಿ.ಲಂಕೇಶ್
4.	ಮೊಬೈಲ್ ಠೇಂಕಾರದ ಜೇನ್ನೊಣಗಳ ಝೇಂಕಾರ :	ನಾಗೇಶ್	ಹೆಗಡೆ
5.	ಆಗಸ್ಟ್ – 6 – ಶಾಂತಿದಿನ – ಶ್ವೇತಭವದನದ	:	ನೇಮಿಚಂದ್ರ
6.	– ಮುಂದೆ 20 ವರ್ಷ		

## ಭಾಗ – 3

ಆಡಳಿತ ಕನ್ನಡ

- 1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ, ಸ್ವರೂಪ, ಲಕ್ಷಣ
- 2. ಆಡಳಿತ ಕನ್ನಡ ಬೆಳೆದು ಬಂದ ದಾರಿ (ಆಡಳಿತ ಕನ್ನಡದ ಇತಿಹಾಸ)

#### ಭಾಗ – 4

ಆಡಳಿತ ಕನ್ನಡ – ಪ್ರಾಯೋಗಿಕ ಬರವಣಿಗೆ

- 1. ಸರ್ಕಾರಿ ಪತ್ರದ ವಿವಿಧ ಅಂಗಗಳು- ಮಾದರಿಯೊಡನೆ
- 2. ವಿವಿಧ ಸರ್ಕಾರಿ ಪತ್ರಗಳು
  - ಅಧಿಕೃತ
  - ಅರೆ ಅಧಿಕೃತ
  - ಅಧಿಕೃತ ಜ್ಞಾಪನ
  - ಸುತ್ತೋಲೆ

ಭಾಗ – 5 ಪದ್ಯಗಳ ಮರುವ್ಯಾಖ್ಯಾನ ಮತ್ತು ವಿಮರ್ಶಾತ್ಮಕ ಚರ್ಚೆಗಳು

#### CORE PAPER I CELL BIOLOGY 4 Credits

**Course Objective:** This course introduces the students to the basics of cell and its components. This gives them a strong foundation on the basic unit of life.

**Course outcomes:** At the end of the course, the student has a strong foundation on the structure and functions of the cell.

**Unit I:** Cell as a basic unit: discovery of the cells, classification of cell types, development of cell theory, early chemical investigation in cell biology. Prokaryotic and Eukaryotic cell organization.

**Unit II:** Cell transport phenomenon: membrane architecture. Active, Passive, diffusion and osmosis. Chemistry of carbohydrates, lipids, proteins and nucleic acids.

**Unit III:** Structure and function of cytoplasmic compartments of the cell: ribosome and protein synthesis, energy flow through mitochondrion, chloroplast and photosynthesis, Golgi apparatus, lysozymes and micro bodies, endoplasmic reticulum, cytoskeleton, vacuoles, peroxysomes, lysozomes and Nuclear compartment. Heterochromatin and euchromatin, polytene chromosomes.

**Unit IV:** Cell division in prokaryotes and eukaryotes: Cell cycle, mitosis, meiosis, crossing over and characteristics of cancer. Apoptosis, Stem cell. Prions.

**Unit V:** Integrative and specialized cellular events, cell-cell signaling, specialized cells nerve cells, sperm cells, microfilaments, microtubules, muscle cells. Cells of vision, Nucleo-cytoplasmic interaction, cell cloning.

- 1. Cell and molecular biology, 3rd edition, Philip Sheeler, Donal E Bianchi, John Wiley. 2014
- 2. Molecular biology of cell, Alberts et al
- 3. Molecular cell biology, Lodish, Baltimore, Scientific American books, 2014
- 4. Molecular and cell biology, Stephen L Wolfe, Wordsworth Publishing company 2011.
- 5. Cell biology. Sadava. 2014
- 6. Cell and Molecular Biology De Roberties 2014

## CORE PRACTICAL-I 4 Credits

- 1. Microscopy
- 2. CellTypes- Microbial, animal and Plant cells
- 3. Fraction of Cellular components-Demonstration.
- 4. MitoticPreparation-Onion Root Tip
- 5. Estimation of Protein-Lowry's method.
- 6. Estimation of DNA byDPA Method
- 7. Estimation of RNA byOrcinolmethod
- 8. Estimation of Sugars by Benedict method
- 9. Estimation of total freeamino acids-Sulfovanicillin method.
- 10.Estimation of Lipids
- 11. AnalysisofOils-IodineNumber-Saponification Value-Acid Number.
- 12.Quantification of Vitamin C.
- 13. Paper Chromatography.
- 14. Preparation of Buffer-Phosphate, Acetate, Tris.
- 15. Principles of Colorimeter, Spectrophotometer and pH.
- 16.Determination of Normality, Molarity, Molality, Percent Solution.

#### ALLIED PAPER I BASICS OF BIOSTATISTICS 3 Credits

**Objectives:** This course imparts the knowledge of basic statistical methods to solve problems. Students are taught to operate various statistical software packages

**Outcomes:** The students are able to appreciate the importance of statistics in research and prepare them for a career in research

**Unit I: Introduction to Statistics:** Definition and Application Of Statistics, Qualitative Data, Quantitative Data, Frequency Distribution, Cumulative Frequency, Diagrammatical Representation Of Statistical Data(Bar, Pie), Graphical Representation Of Frequency Distribution (Histogram, Frequency Polygon, Cumulative Frequency Curves).

**Unit II: Descriptive Statistics:** Measure of Central Tendency: Mean, Median, Mode, Geometric Mean (Merits and Demerits), Measure of Dispersion: Range, Standard Deviation, Variance, (Merits and Demerits), Co-Efficient of Variation.

**Unit III. Probability:** Trial, event, sure event, random event, Sample space, Definition of probability, mutually exclusive events, Independent event, Law's of Probability - simple problems, Normal probability curve.

**Unit IV: Hypothesis Testing:** Hypothesis, Types of Hypothesis, Level Of Significance, Type I and Type II Error, Standard Error, Degrees Of Freedom, Chi Square Test, Student's t Test: One Sample t Test, Paired t Test.

**Unit V: Correlation and Regression: Correlation:** Definition, Types Of Correlation, Karl Pearson's Coefficient Of Correlation, Simple Linear Regression, One Way ANOVA.

## **Reference Books:**

- 1. Fundamentals of Mathematical Statistics (2015) S.C. Gupta and V. K. Kapoor
- 2. Fundamentals of Statistics (2011): S.C. Gupta
- 3. Fundamentals of Biostatistics (2014): Veer Bala Rastogi

## COMPULSORY PAPER ENVIRONMENTAL STUDIES 2 Credits

**Objective:** The main objective of this paper is to create awareness among the students about the environment

**Outcome:** The students will have a better appreciation for the environment and become responsible citizens

**Unit I:** The Multidisciplinary nature of environmental studies: Natural Resources. Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit II:** Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit III:** Environmental Pollution: Air pollution; Water pollution; Soil pollution

- 1. Y.K. Sing: Environmental Science, New Age International Pvt, Publishers, Bangalore. 2011
- 2. Agarwal, K.C. 2011 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- 3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad. India,
- 4. Brunner R.C., 2015, Hazardous Waste Incineration, McGraw Hill Inc. 2015
- 5. Clark R.S., Marine Pollution, Clanderson Press Oxford 2015
- 6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2011, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2015
- 7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 2011
- 8. Down of Earth, Centre for Science and Environment 2011

## SEMESTER II

#### PAPER I ENGLISH II

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

Unit I. Passages 1 to 4

**Unit II:** Grammar - Correct Use of Adverbs; Correct use of Prepositions; Reported Speech

Unit III: Roots (O to T); Prefixes; Suffixes

**Unit IV:** Grammar - 1. Correct Use of Conjunctions; 2. Correct use of Articles; 3. Parallelism

**Unit V:** Roots (U to Z ); New Words in English

#### PART II

#### ENGLISH II

**Unit I**: Passages 1 to 5

**Unit II**: Poems: "The Frog and The Nightingale" by Vikram Seth and "Ozymandias" by P.B Shelly

**Unit III:** Prose - 1. "Such Perfection" By R.K Narayan and 2. "Retrieved Reformation" by O" Henry

**Unit IV:** Poems; "Wild Swans at Coole" by W.B Yeats; "Lucy Grey" by William Wordsworth; "Stopping by Woods on a Snowy Evening" by Robert Frost

**Unit V:** Prose: "His Wedded Wife" by Rudyard Kipling and "The Merchant of Venice" (trial scene) by Shakespeare

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ಎರಡನೇ ಸೆಮಿಸ್ಟರ್
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ಪತ್ರಿಕೆ - 2 : ಸವಿಸ್ತರ - ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 2
ಭಾಗ – 1
ಸವಿಸ್ತರ ಪಠ್ಯ
1.
       ನಾಟಕ – 1
ಕಾಕನಕೋಟೆ – ಮಾಸ್ತಿ ವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್
ಭಾಗ – 2
ಅವಿಸ್ತರ ಪಠ್ಯ
1.
       ಕಾದಂಬರಿ/ವೈಚಾರಿಕ ಬರಹ
       ಒಡಲಾಳ – ದೇವನೂರು ಮಹಾದೇವ
ಭಾಗ– 3
ಆಡಳಿತ ಕನ್ನಡ – 2
1.
       ಅರ್ಜಿ : ಸ್ವರೂಪ ಮತ್ತು ವಿವಿಧ ಬಗೆಗಳು
       ಕಡತ (ಫೈಲು)
2.
7.
       ಕಚೇರಿ ಕಾರ್ಯವಿಧಾನ ಮತ್ತು ಕಚೇರಿ ಟಿಪ್ಪಣಿಗಳು
8.
       ಸರ್ಕಾರಿ ಪ್ರಕಟಣೆ, ಜಾಹೀರಾತು (ಸ್ವರೂಪ–ರಚನೆ)
ಭಾಗ– 4
ಸವಿಸರ ಪಠ್ಮ
ಕಾಕನಕೋಟೆ ನಾಟಕದಲ್ಲಿನ ಪಾತ್ರಗಳು, ಘಟನೆಗಳ ಸ್ರಾರಸ್ಯ ವಿವರಣೆ ಮತ್ತು ವಿಶ್ಲೇಷಣೆ
ಭಾಗ – 5
ನಾಟಕ ಮತ್ತು ಕಾದಂಬರಿಗಳ ಕುರಿತು ವಿಮರ್ಶೆ ಮತ್ತು ಚರ್ಚಾತ್ಮಕ ವಿಶ್ಲೇಷಣೆ
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## CORE PAPER II MICROBIOLOGY 4 Credits

**Course Objective:** This fundamental paper discusses the importance of microorganisms. The course throws light on types of microorganisms in and around humans.

**Course outcomes:** At the end of the course, the student has understanding on the metabolism and mechanism of microbial life

**Unit I:** Definition and scope of microbiology-- A general account on microbial diversity.Basic principles in microscopy, Types of microscopes- light, dark, phase contrast, fluorescent and electron microscope- (Transmission and Scanning electron).

**Unit II:** A detailed account of General structure, growth and reproduction of the various Bacteria, fungi and Viruses. Economic and industrial importance of yeast and moulds.

**Unit III:** Microbiological Media: Types, preparation, methods of sterilization; enumeration of microorganisms in soil, water and air; isolation of microorganisms from Environment and infected tissue; Techniques of pure culture, maintenance and Preservation; Staining: stains and types of staining.

**Unit IV:** Physiology and biochemistry of microbes--Nutrition (Photo-autotrophs, Chemo- autotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, endozoic microbes) -- microbial pathogens of plants, animals and Humans.

**Unit V:** Respiration and fermentation, Nitrogen metabolism including Nitrogen fixation (Symbiotic and asymbiotic), Lipid metabolism, Secondary metabolism, Production of enzymes and antibiotics--Role of microbes in biogeochemical cycles.

## Reference Books:

- 1. Michael T. Madigan John M. Martin & Jack Parker, 1984, Biologyof Microorganisms PrenticeHallInternational, Inc., London.
- 2. Edward A.Birge, 1992, Modern Microbiology Principles and application. Wm.C. Brown Publishers, Inc. U.S.A.
- 3. Gerard J. Tortora, BerdellR. Funke, Christine &L. Case, 2001, Microbiology- An Introduction. Benjamin Cummings, U.S.A.
- 4. DanialLim, 1998, Microbiology, McGraw-HillCompanies, New York.
- 5. Stephen A. Hill, 1984, Methods in Virology.Blackwell ScientificPublication,London.

#### CORE PRACTICAL II 4 Credits

- 1. Laboratoryrules and regulations of Microbiology
- 2. Mediapreparation and sterilization
- 3. Enumerationofmicroorganismfromsoil, waterandspoiledfood-serialdilution technique.
- 4. Pure culturetechnique-Pour plate spread plate and streak platemethods.
- 5. Isolation of single colonies of bacteria
- 6. Auxotrophic selection
- 7. Measurement ofgrowthofbacteria.
- 8. Measurement ofgrowthofPhage.
- 9. Stainingof bacteria -Gram's; Spore, capsule, acidfast bacilli.
- 10. Fungal Staining-Wet Mount technique.
- 11.IMVIC test
- 12. Antibioticsensitivitytest.

#### Allied Paper II Principles of Biochemistry 3 Credits

**Objectives:** The course aims to provide exposure to the students regarding the importance of biological macromolecules and their role in reactivity of biomolecules

**Outcomes:** At the end of the course, the students have a thorough understanding on the role of biomolecules and their functions. Being an allied paper it ensures to create enough relevance with role of biomolecules in life to all disciplines like biotechnology, microbiology, food, nutrition and dietetics; as well as environmental sciences.

**Unit I:** Introduction of Cells, Water, Thermodynamics, Bonds, Photosynthesis and Respiration.

**Unit II:** Carbohydrates-Classification, Metabolism: Glycolysis, Gluconeogenesis, Krebs Cycle, Pentose Phosphate Pathway, Glyoxylate cycle. Electron Transport Chain, ATP Synthesis.

**Unit III:** Classification of Amino Acids. Peptide bond, Peptides, Protein structure, Enzymes action and classification. Nitrogen cycle. Amino acid metabolism and degradation.

**Unit IV:** Classification of lipids, Fatty acid oxidation and synthesis, Lipid bilayer, Lipid transport. Ketone bodies.

**Unit V:** Nucleic acids: Types of DNA and RNA, Central dogma of Molecular Biology, Replication, Transcription and Translation.

- 1. Nelson, D. L. & Cox, M. M. Lehninger, 2013, Principles of Biochemistry. Freeman - 6th edition,
- 2. U Satyanarayana, 2013, Biochemistry. Elsevier. 5th Edition.
- 3. Berg, J. M., Tymoczko, J. L. and Stryer, L. 2011, Biochemistry. Freeman -7th edition.
- 4. Voet, D., Voet, J. G., & Pratt, C. W. 2011. Fundamentals of Biochemistry (pp. 408-409). New York: Wiley – 4th edition.
- 5. Conn, E., &Stumpf, P. 2016. Outlines of Biochemistry. John Wiley & Sons 5th edition.
- 6. West, E. S., Todd, W. R., Mascon, H. S., & Van Bruggen, J. T. 2014. Textbook of Biochemistry. Oxford and IBH Publishing - 4th Edition
- 7. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J. 2013. Molecular Cell Biology, Freeman 7th edition.

#### SEMESTER III

## ENGLISH III

#### PART I

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Passages 1 to 5

Unit II: Grammar; Active and Passive Voice and Modal Auxiliaries

**Unit III**: Vocabulary; Homonyms; Figures of Speech: Alliteration, Metaphor and Simile

**Unit IV**: Grammar: Foreign expressions and Phrasal Verbs

**Unit V**: Vocabulary - Figures Of Speech: Antithesis, Hyperbole, Euphemism, Iro

## ENGLISH III PART II

**Unit I.** Passages 1 to 5

**Unit II.** Poetry: "On His Blindness" by John Milton; "Solitary Reaper" by William Wordsworth; "The Road Not Taken" by Robert Frost

**Unit III.** Prose: "The Sniper" by Liam O' Flaherty and "A Hero" by R K Narayan

**Unit IV**: Poetry: "Where The Mind is Without Fear" by Rabindranath Tagore; "Ode To Autumn" by John Keats; "Lord Ullin's Daughter" by Thomas Campbell

**Unit V.** Prose: "The Open Window" by Saki and "The Bishop's Candlesticks" by Victor Hugo

#### ಪತ್ರಿಕೆ– 3 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 2

ಭಾಗ – 1

- ನಿಗಧಿತ ಭಾಗಗಳು: (ನಿಗಧಿತ ಪದ್ಯಗಳು ಮತ್ತು ಕಥಾಭಾಗ)
- 1. ಪಂಪನ ವಿಕ್ರಮಾರ್ಜುನ ವಿಜಯ: ದ್ವಾದಶಾಶ್ವಾಸಂ ಮಾನಸರೇನಿನ್ನೂಲು ವರ್ಷಮಂ ಬಲ್ಧಪರೇ
- 2. ಜನ್ನನ ಯಶೋಧರ ಚರಿತೆ ಮಾಡಿದುದಂ ನಾವುಣ್ಣದೆ ಪೋಕುಮೆ

#### ಭಾಗ – 2

- 1. ನಿಗದಿತ ಹತ್ತು ವಚನಗಳು ಬಸವಣ್ಣ । ಅಲ್ಲಮಪ್ರಭು । ಅಕ್ಕಮಹಾದೇವಿ । ಅಂಬಿಗರ ಚೌಡಯ್ಯ ಅಮುಗೆ ರಾಯಮ್ಮ
- ಗೀತೆಗಳು : ಸಂಗ್ರಾಹಕ ಸಂಪಾದಕ : ಮತ್ತಿಘಟ್ಟ ಕೃಷ್ಣಮೂರ್ತಿ ಜನಪದ ಗೀತೆ : ಮುಕ್ಕಣ್ಣ ಮಳೆಯ ಕರುಣಿಸು
   ಸುವವರ್ಷನ್ ಸವಾದು ಭಾಗನ ಸವಾನಂಬಿ ಬರಣನೆಗೆ
- ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ : ಅರಣ್ಯಪರ್ವ ಸೌಗಂಧಿಕದ ಪವನನ ಬಳಿವಿಡಿದು

#### ಭಾಗ – 3

ಅವಿಸ್ತರ ಪಠ್ಯ

ಸಮಾಜಸುಧಾರಕ ಮಹಾತ್ಮಪುಲೆ (ಮೂಲ ಮರಾಠಿ ಕರ್ತೃ : ಮುರಳೀಧರ ಜಗತಾಪ) ಕನ್ನಡಕ್ಕೆ ಅನುವಾದಕರು : ಅಕಿಂಚನ – ನವಕರ್ನಾಟಕ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು.

#### ಭಾಗ – 4

- 1. ಕನ್ನಡ ಪದಕೋಶದ ಬೆಳವಣಿಗೆ
- 2. ದೇಸಿ, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು ಮತ್ತು ಪಾರಿಭಾಷಿಕ ಪದಗಳು
- 3. ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಸಂಪಾದಕರಿಗೆ ಪತ್ರ
- 4. ವರದಿ

#### ಭಾಗ – 5

- 1. ಪ್ರಾಚೀನ ಹಾಗೂ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಸಾಂಸ್ಕೃತಿಕ, ಸಾಮಾಜಿಕ ಮತ್ತು ರಾಜಕೀಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಪಠ್ಯದ ವಿಮರ್ಶೆ
- 2. ಜೀವನ ಚರಿತ್ರೆಯ ಸ್ವರೂಪ ಲಕ್ಷಣ ಹಾಗೂ ನಿಗಧಿತ ಪಠ್ಯದ ಅವಲೋಕನ.

#### CORE PAPER III BIOCHEMISTRY 4 Credits

**Course Objective:** Through this course the students are exposed to importance of biological macromolecules. They acquire knowledge in the quantitative and qualitative estimation of biomolecules. They study the influence and role of structure in reactivity of biomolecules.

**Course Outcomes:** At the end of the course, the students have a thorough understanding on the role of biomolecules and their functions

**Unit I:** Structure of atoms and biomolecules: Atomic theory, Valency, Atomic weight, Molecular weight, Molarity. Chemical Bonding - Electrostatic, Covalent, Ionic and Vander waals, Structure of water molecules, properties and ionization of Water, pH and buffers. Laws of Thermodynamics.

**Unit II:** Enzymes and co-enzymes, IUB classification and nomenclature of enzymes, regulation of enzyme activity, active sites, activators and inhibitors; Isoenzymes, allosteric enzymes.

**Unit III:** Definition, Nomenclature, Classifications and Structures of sugars. Structural features of polysaccharides. Glycolysis, TCA cycle, Glycogen breakdown and synthesis, Gluconeogenesis, Bioconversion of pentoses and hexoses,

**Unit IV:** Definition, Nomenclature, Classifications and Structure of lipids, Metabolism of lipids: Fatty acid biosynthesis and oxidations.

Amino acids and peptides – classifications, Structural Organization of protein (primary, secondary, tertiary and Quaternary), Functions of proteins.

**Unit V:** Definition, Nomenclature, Classifications and Structure of nucleic acids, Biosynthesis and degradation of nucleic acids (purines and pyrimidines) Integration of metabolism and regulations.

- 1. Boyer.R., (2002) Concepts in Biochemistry 2nd ed. Brooks / Cole publishing companyNew York.
- 2. David L. Nelson and M. Cox (2003) Lehninger's Principles of Biochemistry, 3rd Ed, Worth publication New York
- 3. Voet and Voet (1995) Fundamentals of Biochemistry, 2nd Edition, John Wiley and sons inc., New York.
- 4. Geoffery L Zubay (1995) Principles of Biochemistry, WCB publishers, London
- 5. Murrey RK. D.K. Granner, P.A. Mayers and V.W. Rodwell, (2003) Harper's Biochemistry, Prentice –Hall Int, Boston
- 6. Outlines of Biochemistry Conn & Stumph (2014).

#### CORE PAPER IV CLASSICAL GENETICS 4 Credits

**Objective Objective:** Students will be taught Mendelian genetics, their principles and gene interaction. They learn about chromosomal aberrations and structure of chromosomes.

**Course outcomes:** The student will gain a basic understanding on human genetics and hereditary.

**Unit I:** History of Genetics-Mendelian Principles, Segregation, Independent Assortment, Dominance. Multiplealleles, Pseudoalleles, Incomplete dominance, over dominance and co dominance, complementation test.

**Unit II:** Geneinteraction, Epistasis, penetrance and expressivity, lethality and lethal genes. Sex determination and sex linkage indiploids, linkage and crossing over, gene mapping. Chromosomal theory of inheritance and maternal effects.

**Unit III:** Chromosomal variationin number, Changes inChromosomal structure,Chromosomal aberrations,Geneticsof Heamoglobin,Transposable elementsinprokaryotesand eukaryotes.

**Unit IV:** Structure of chromosome, fine structure of Gene, cistron, recon, Structure of Eukaryotic gene, Experimental evidence for DNAasthegenetic material, cytoplasmic genetic systems-mitochondria and chloroplast DNA.

**Unit V.** Genetic control of Development in Drosophila and Arabidopsis. Population genetics, calculating gene frequency, factors affecting gene frequency. Geneticdrift, Shift, Pedigree analysisandgeneticcounselling.

## Reference Books:

- 1. Basicgenetics by D.L.Hartl, 1991, Jonesand Bartettpublic.
- 2. Friedfelder1987, Microbialgenetics, Jonesand Bartett public.
- 3. Molecular Biology of the genes 4thEd. Watson The Benjamin/Cummings coins 1987
- 4. Molecularbycell biology, 1994.Lodish, BaltimorescientificAmerican books, Inc.
- 5. Genetics byGoodenough

## ALLIED PAPER III FUNDAMENTALS OF BIOINFORMATICS 2 Credits

**Objectives:** This allied paper introduces the students to concepts in bioinformatics **Outcomes:** The student will be able to apply basic principles of biology, computer science and mathematics to address complex biological problems

**Unit I:** Introduction and history of bioinformatics–Internet, World Wide Web, Web browser, EMBnet, NCBI. File transfer protocol.

**Unit II:** Database browsers and search engines. Introduction to MS access, making queries, Designing forms, Report design

**Unit III:** Database-Definition, DBMS, Biological Databases– FASTA, Blast, Genbank, DNA sequence data bases, Protein databases.

**Unit IV:** Entry formats, carbohydrate databases, Enzyme databases, Pathway databases. Relational data base model. Theory on RDBMS. SQL.

**Unit V:** Application aspects – gene prediction, target searching's – drug designing – E-cell, phylogenetic analysis, PERL, Chemo-informatics.

## **Reference Books**:

- 1. Introduction to Bioinformatics. T.K.Altwood, D.J.Parry-Smith (2014) Pearson Education.
- 2. Bioinformatics for the beginners by K. Mani & N. Vijayaraj (2015). Jaypee Publishers.
- 3. Proteomics- Pennigton & Dunn (2012). Viva books publishers, New Delhi
- 4. Bioinformatics-A practical guide to the analysis of genes & protein. 2nd Edition. Andreas, Baxevanis and Francis Ouellette.

#### SKILL BASED PAPER I BASICS OF COMPUTERS 4 Credits

**Objectives:** This is a skill-based paper that introduces the students to the basics of computer operations. The student is imparted with knowledge on both hardware and software.

**Outcomes:** The student has a better understanding on the use of computers for various applications

**Unit-I:** Fundamentals of Computer, MS- Office, and Operating System

Unit-II: Basics of HTML, HTML 5, J- Query, Database Management System

Unit-III: Basic Networking, VB- Visual Basics, Data Structure using C++

**Unit-IV:** Software Engineering, Asp.net, Computer Graphics.

Unit-V: Training on SPSS Software

#### **Reference Books:**

1. Rajib Mall, Fundamentals of Software Engineering (2015), Prentice Hall of India.

### SEMESTER IV PART I ENGLISH IV

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Comprehension Passages and Poems

Unit II: Grammar: Formal Letter Writing and Report Writing

Unit III. Grammar: Story writing. Subject Verb Agreement. Essay writing

**Unit IV**: Vocabulary: Onomatopoeia and Personification

**Unit V**: Vocabulary: Pun, Role Plays and Headline English

## PART II ENGLISH IV

**Unit I**. Poetry: "Mending Wall" by Robert Frost" and "I Know Why a Caged Bird Sings" by Maya Angelou

**Unit II.** Poetry: "Ode to the West Wind" By P. B Shelly, "The Brook" by Alfred Tennyson and "This is going to hurt "by Ogden Nash

Unit: III. Prose - "An Astrologers Day" By R K Narayan and Mahatma Gandhi

Unit IV: Prose: "The Refund" by Fritz Karinthy

**Unit V: Prose:** "The Last Leaf" by O 'Henry

ಪತ್ರಿಕೆ – 4 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ

ಭಾಗ – 1

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ – 1 : ( 6 ಸುನೀತಗಳು)			
1. ಕವಿತಾವತಾರ	:	ಎಂ. ಗೋವಿಂದಪೈ	
2. ಜೀವ ರೇಶಿಮೆಯ ಹುಳು	:	ಮಾಸ್ತಿ ವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್	
3. ಅಲ್ಲಮಪ್ರಭು	:	ದ.ರಾ.ಬೇಂದ್ರೆ	
4. ವರ್ಡ್ಸ್ವರ್ತ್	:	ಕುವೆಂಪು	
5. <del>ಕ</del> ವಿ	:	ಮ.ತಿ.ನ	
6. ಕಾಲ್ಚೆಂಡೆ	:	ಈಶ್ವರ ಸಣಕಲ್ಲ	

ಭಾಗ – 2

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ - 2 : ( 6 ಸುನೀತಗಳು)

1.	ಸಣ್ಣಸಂಗತಿ	:	ಕೆ.ಎಸ್.ನ
2.	ತವರ ಮನೆಯಿಂದ ನಾ ನಿನ್ನ ಕರೆಸಿದನೇಕೆ	:	ವಿ.ಜಿ.ಭಟ್ಟ
3.	ಸ್ಥಾವರಕ್ಕಳಿವುಂಟು	:	ಜಿ.ಎಸ್.ಎಸ್
4.	eo๋ฮd ้	:	ಚೆನ್ನವೀರ ಕಣವಿ
5.	ಅನುಭವ ಮಂಟಪ	:	ಜಿ.ಎಸ್.ಸಿದ್ದಲಿಂಗಯ್ಯ
6.	ದೈವ ಕಲಿಸುವ ಪಾಠ	:	ಕೆ.ಎಸ್.ನಿಸಾರ್ ಅಹಮದ್

#### ಭಾಗ – 3

ಅವಿಸ್ತರ	ತ ಪಠ್ಯ– ಗದ್ಯಭಾಗ : ಕಥೆಗಳು		
1.	ಶುಕ್ರಚಾರ್ಯ	:	ಬಾಗಲೋಡಿ ದೇವರಾಯ
2.	ನಲ್ಲಿಯಲ್ಲಿ ನೀರು ಬಂತು	:	ಕೆ.ಸದಾಶಿವ
3.	ನಿರಾಕರಣೆ	:	ವೀಣಾ ಶಾಂತೇಶ್ವರ
4.	ಬುರ್ಖಾ	:	ಫಕೀರ್ ಮಹಮ್ಮದ್ ಕಟ್ಟಾಡಿ
5.	ಅಲ್ಲಿ ಆ ಅಳು ಈಗಲೂ	:	ಮೊಗಳ್ಳಿ ಗಣೇಶ್

#### ಭಾಗ – 4 ಆಡಳಿತ ಕನ್ನಡ

- 1. ಗಾದೆಯ ಸ್ವರೂಪ, ಬಳಕೆ ಮತ್ತು ವಿಸ್ತರಣೆ
- 2. ವಾಕ್ಯ ರಚನೆ : ಸರಳ ವಾಕ್ಯಗಳು, ಸಂಕೀರ್ಣ ವಾಕ್ಯಗಳು

3. ಪ್ರಬಂಧದ ಸಾಮಾನ್ಯ ಸ್ವರೂಪ, ರಚನೆ

4. ಸಂಕ್ಷೇಪನ ಲೇಖನ ಸ್ವರೂಪ, ಪ್ರಾಯೋಗಿಕ ರಚನೆ

#### ಭಾಗ – 5

1. ನವೋದಯ ಸಾಹಿತ್ಯದ ಕಾಲಘಟ್ಟದಲ್ಲಿ ಸುನೀತ ಪ್ರಕಾರದ ಹುಟ್ಟು ಬೆಳವಣಿಗೆ.

2. ಸುನೀತದ ಲಕ್ಷಣ, ಸ್ವರೂಪಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಾವ್ಯಭಾಗದ ವಿವೇಚನೆ

3. ಧಾರ್ಮಿಕ, ರಾಜಕೀಯ ಹಾಗೂ ಸಾಮಾಜಿಕತೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಥಾಭಾಗದ ವಿಮರ್ಶೆ

#### CORE PAPER V MOLECULAR GENETICS 4 Credits

**Objective Objective:** The course teaches the students about genes at molecular level. •They learn about DNA, RNA and their replication, mutations, DNA repair mechanism.

**Course Outcomes:** The course outcome is to train the students in understanding genetics and relate modern DNA technology for disease diagnostics and therapy

**Unit I:** Organizationofgenome–Structureand functions of DNA and RNA. Experiment to prove semi conservative mode of replication. DNA replication in prokaryotes and eukaryotes.Types unidirectional, bidirectional and the model replication. Enzymology of replication.

**Unit II:** Gene expression-Colinearity, Transcription, posttranscriptional modifications (mRNA, tRNA, rRNA), transcriptional regulation in prokaryotes (operon concept-lacoperon) and eukaryotes, inhibitors of transcription. Elucidation of genetic code.

**Unit III:** Translation of protein–posttranslationalmodificationsandfoldingofnewly assembled polypeptides, translational regulations, signal sequences and protein export.

**Unit IV:** Gene mutation–Biochemicalbasisofmutations–typesof mutations- spontaneousand inducedmutations; Ames test for mutation; DNA damage–types of DNA repair mechanisms–photo reactivation excision repair, post replication recombinantre pair, SOS repair.

**Unit V:** Recombination- Homologous and non-homologous recombination, including transposition, site – specific recombination. Genetic exchange–bacterial transformation, transduction, conjugationand theirmapping.

- 1. Basic Genetics by D.L. Hartl 1991, Jones & Bartett publications.
- 2. Microbial Genetics, Friefelder1987– Jones & Bartnett publications
- 3. MolecularBiologyofthegene4thedition byWatsonetal, TheBenjamin/Cummings co
- 4. MolecularCellBiologyby Lodish 1994, Baltimore Scientific American Brocks.

### ALLIED PAPER IV FUNDAMENTAL OF NANOTECHNOLOGY 3 Credits

**Objectives**: This is an interdisciplinary and emerging area. The students are taught the basics of nanotechnology and their applications **Outcomes**: The course introduces the students to the new and novel applications to solve biomedical problems through nanotechnology

**Unit I: Introduction to Nanotechnology:** Fundamentals of Nanoscience, History of Nanoscience and Nanotechnology, Properties of nanomaterials - optical, electronic and magnetic properties.

**Unit II: Classes of Nanomaterials:** Metal and Semiconductor Nanomaterials, Quantum Dots, Carbon Nanotubes and Bucky balls. Organic based nanomaterials – liposomes, dendrimers, and micelles. Inorganic based nanomaterials – gold/ silver nanoparticles and magnetic nanoparticles

**Unit III:** Synthesis Nanomaterials: Top down method of synthesis - Nanolithography, CVD, ball milling. Bottom-up method of synthesis – Colloidal synthesis, solgel method, Self-assembly methods.

**Unit IV: Physicochemical characterization on Nanomaterials:** Optical method (UV - Vis absorption and fluorescence spectroscopy), electron microscopy techniques (SEM and TEM).

**Unit V: Applications of Nanotechnology:** Environmental applications – Green nanotechnology- green synthesis of nanoparticles, Nanomaterials as solution to environmental problems. Pesticide removal in ground water using nanoparticles. Industrial applications of nanotechnology; Cosmetic Industry – nanoparticles based sunscreens, antimicrobial creams. Food Industry – Antimicrobial coatings and smart packaging. Nanomaterial based food supplements. Textile Industry – Stain resistant textiles, self-cleaning and flame resistant textiles. *Agriculture sector* – Crop improvement, Nano-fertilizers. Nanomedicine – Cancer Nanotherapy and Point of care diagnostics

## **Reference Books:**

- 1. A.Nabok, "Organic and Inorganic Nanostructures", Artech House, 2011
- C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2017
- 3. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2012

# ALLIED PRACTICAL-III&IV: BIOINFORMATICS & NANOTECHNOLOGY

- 1. To calculate the absorption coefficient from UV-Vis spectrometer
- 2. To do the peak analysis of IR transmission spectrum using FTIR spectrometer
- 3. Trace out the emission spectra for UV excited luminescent sample
- 4. To determine particle size of nanoparticles using UV spectra
- 5. To synthesis nanoparticles using colloidal method

#### SKILL BASED PAPER II Tissue Culture 4 Credits

**Objectives:** This skill based course introduces the students to the concepts in tissue culture applicable to plants and animals

**Outcomes:** They are also taught their applications in biotechnology and biochemical research. This course introduces the students to explore entrepreneurial avenues in this field

**Unit I:** Types of Plant Cultures: Introduction to organogenesis, Production of haploid plants and their applications, Ovary and ovule culture, In vitro pollination and fertilization, Pollen culture, Anther culture, Embryo culture: History and methodology, Embryo rescue after wide hybridization, Applications, Somatic embryogenesis, Endosperm culture and production of triploids, Single cell suspension cultures and bioreactors, Protoplast isolation and culture, Meristem, axillary and shoot tip culture: micro propagation

**Unit II:** Applications of Plant Tissue Culture, Soma clonal variation and applications, Somatic Hybridization and its applications, Virus free plants, Germplasm conservation, Synthetic seeds, DNA transformation methods in plants and applications, Hairy root culture, Secondary metabolite production

**Unit III:** Types of Animal cell culture, Organ culture, Primary explant cultures, and Established cell lines, commonly used cell lines: origin and characteristics, Growth kinetics and cells in culture, Bioreactors for large scale culture of cells, Cell fusion, Transplantation of cultured cells (Grafting)

**Unit IV:** Applications of animal cell culture, Limitations and ethical issues, Transfection and transgenic animals, Expressing cloned products in animal cells, The need to express in animal cells, Over production and processing of chosen protein, Production of special secondary metabolites/ products (insulin, growth hormone, interferon, t – plasminogen activator, factor VIII etc), Production of vaccines using animal cell culture, Production of monoclonal antibodies and its applications, In vitro fertilization

**Unit V:** Study of laboratory equipment's, Stocks and Media preparation, Sterilization techniques in plant tissue culture, Explant selection, treatment and inoculation, Subculture of initiated cultures, Acclimatization of cultures, Extraction of proteins from plants and its estimation, Extraction of DNA/RNA from plants and its estimation, Estimation of peroxidase activity in plants, Study of  $\beta$  – amylase enzyme from germinated pulses, Demonstration of animal cell culture technique. **Reference Books:** 

- 1. Plant Tissue Culture, Theory and Practice, Rev Ed S. S. Bhojwani, M.K. Razdan. (2015)
- 2. Animal Cell Culture and Technology– M Butler. (2014)
- 3. Freshney's Culture of Animal Cells. (2011).

## **SEMESTER V**

#### CORE PAPER VI IMMUNOLOGY 4 Credits

**Objective Objective:** This course gives an overview on the immune system including organs, cells and receptors. The student learns about molecular basis of antigen recognition hypersensitivity reaction, antigen-antibody reactions.

**Course Outcomes:** The course develops in the student an appreciation for principles of immunology and its applications in treating human diseases

**Unit I:** Introduction-Historical Development in Immunology.Immunity-Humoral and Cell mediatedresponse, Primary and Secondary immuneresponse. Cells involved inimmune response.Innate and Acquired Immunity. Mechanisms of defense.

**Unit II:** Antigen – Types and classifications. Antibody –Structure, Types, properties and their biological functions, polyclonal sera. Monoclonal antibody. Primary and Secondary lymphoid organs. Thymus, Bone marrow, Lymph nodes and Spleen. Lymphocytes traffic and regulation, CD molecules

**Unit III:** Hematopoiesis and development of Band Tlymphocytes.Immunoglobulin Gene expression B cell and Tcellactivation.MHC molecules Response of Bcellstoan-tigens. PlasmaCells, MemoryCells.

**Unit IV:** Complement–activationandregulation.Cytokines- structure andfunctions, Interferon and interleukins. Immunoregulation: Tolerance. Suppression, Autoimmunity and hypersensitivity reactions .Primary and secondary Immuno deficiency disorders.

**Unit V:** Transplantation, HLA Typing; Mechanism of Graft rejection. Tumor immunology. Immuno surveillance-mechanisms. Antigen – Antibody Interactions. Immuno diffussion and Immunoelectrophoresis. Principle and Applications of RIA, ELISA, Fluorescent Antibody techniques.

- 1. Immunology– Kuby., J -5thEdition
- 2. Immunology– Tizard
- 3. Immunology-Ivan M.Roitt- Third Edition
- 4. Immunobiology– Janewayand Travers– 5<sup>th</sup>Edition
### CORE PAPER VII PLANT AND ANIMAL BIOTECHNOLOGY 4 Credits

**Objective Objective:** This course teaches organization and expression of plant and animal genome and plant and animal tissue culture. Students learn about transgenic animal, their application in pharmaceutical industry, cloning and its importance.

**Course Outcomes**: This course prepares the students in appreciating the its benefits and applications in biotechnological, pharmaceutical, medical and agricultural field

**Unit I:** Introduction to cell and tissue culture. Plant tissue culture media (composition, types and preparation), plant hormones and growth regulators in tissue culture. Preparation of suitable explants for organo genesis. Micro propagation onlarge scale, somatic embryogenesis, protoplast culture and somatic hybridization. Anther, pollen and ovary culture for production of haploidplants and homo-zygouslines, cell culture methods for the secondary metabolite metabolite production, somaclonal variation and its significance, Cryopreservation, Gene banksfor germplasm conservation.

**Unit II:** Plant transformation techniques – Mechanism of DNA transfer – Agrobacterium mediated gene transfer, general feature soft and RI plasmids and the viruse as vectors, role of virulence genes. Design of expression vectors ;use of 35 Sand other promoters, reporter genes; viral vectors; direct gene transfer method sparticle bombardment, electroporation, micro injection-vector construct with reference to tobacco. Molecular marker aided breeding, RFL Pmaps, RAPD markers and SCAR (Sequence Characterized applied regions).

**Unit III:** Animal cell cultures: Culture media – composition and preparation, Balanced salt solution and simple growth medium, chemical, physical and metabolic functionsof differentconstituentsofculture medium. Role of CO2, serum and protein-free defined media and their applications. Culturing and maintenance of different animal cell lines (Primary andestablished cell lines). Characterization of cultured cell, measurement of viability, cyto-toxicity and growth parameters. Stem cell cultures, embryonic stem cell and their applications, cellculture based vaccines, measurement of cell death, apoptosis, scaling up animals cell cultures and production of recombinantgeneproducts.

**Unit IV:** Transgenic animals: Method of obtaining transgenic animal susing fertilized eggs and embryonic blastocyst cell, example, importance of transgenic animals – increased productivity of domestic animals, improved desired characters of domestic animals, and production of proteins for pharmaceutical use. Animal models for tackling human diseases (Geneknock out and mice models). Transgenic silk worms. Animal cloning: Methods of cloningin animal system– Rat, Sheep, pig; importanceof cloning.

**Unit V:** Diagonostic: Application of immunological and molecular diagnostic method (RIA, ELISA,PCR,DNA finger printing) in forensic medicine and disease diagnostics..Gene therapy and cell medicated therapy. Geneticdiseases targeted for gene therapy.

# **Reference Books:**

- 1. Plant geneticengineering, Dodds J.H. (2015).
- 2. Plant molecule biology, Grierson and S.V. (2014).
- 3. Molecular biotechnology: Principle and applications of recombinant DNA technology. Bernard.
- 4. Animal cell culture apracticalapproach. 4th edition. Freshney. John WileyPub.
- 5. Mammalian Cell Biotechnology-A practical approach. EDButler.Oxford UNI-Press.

# CORE PAPER VIII MEDICAL MICROBIOLOGY 4 Credits

**Objectives:** This interdisciplinary course teaches the students interactions between human and microbes, diseases caused by microbes. They learn about culture, collection, handling and transport of clinical samples. They also learn about diagnosis of various microbial diseases.

**Outcomes:** At the end of the course students will be able to identify diseases and understand the treatment plan.

**Unit I. Infection and Pathogensis:** History and Development of Medical Microbiology Microbial flora of human body. Infection- Types of infection, modes of transmission, Portal of entry. Pathogenesis- Virulence- Attenuation and exaltation with an example each.

**Unit II. Clinical Microbiology and Nosocomial Infections:** Laboratory specimens: a) Collection of samples. b) Handling and Transport of laboratory specimens. **Nosocomial infections:** Common types, Sources and Reservoirs of Hospital acquired infections. Microorganisms causing Nosocomial infections.

**Unit III. Bacterial and Vral Diseases of Human Beings:** Pathogen- Morphology, cultural characteristics, classification, pathogenesis, clinical symptoms, laboratory diagnosis, epidemiology, prophylaxis and treatment of the following human diseases: Bacterial- Typhoid, Syphilis, Tuberculosis, and Anthrax. Viral- Poliomyelitis, Hepatitis, AIDS

**Unit IV. Fungal and Protozoan Dieeases of Human Beings:** Pathogen- Morphology, cultural characteristics, classification, pathogenesis, clinical symptoms, laboratory Diagnosis, epidemiology, prophylaxis and treatment of the following human diseases: Fungal- Dermatomycosis, Candidiasis. Protozoan- Malaria, Amoebic dysentery.

**Unit V. Antibiotics and Antibiotic resistance:** General characteristics and types of antibiotics. Characteristics and mode of action of Penicillin, Streptomycin and Chloramphenicol. Drug Resistence- Mechanism, Multiple Drug Resistance (MDR).

### **Reference Books:**

1. Mackieand Mc Catney, 1994, Medical Microbiology NoI and II. Churchill Livingston, 14th Edition.

- 2. Ananthanarayanan R and CK Jayaram Panicker, 1994, Textbook of microbiology Orient Longman.
- 3. Chakraborty P 1995, AText book of microbiology, New Central Book Agency Pvt Ltd. Calcutta.
- 4. Bailey and Scotts, 1994, Diagnostic Microbiology, 9th edition, Baron and Fine gold CVM Publications.
- 5. Jawetz EMelnic JL and Adel berg EA. 1998. Review of Medical Microbiology. Lange Medical Publications, USA.

# CORE PRACTICAL V 4 Credits

- 1. Differential WBC count in a given human blood sample.
- 2. Antibiotic sensitivity test.
- 3. Determination of blood groups and Rh factor.
- 4. Determination of precipitation reaction- Ouchterlony method.
- 5. Detection of typhoid by WIDAL test and syphilis by RPR test.
- 6. Isolation of DNA.
- 7. PCR Demo
- 8. Study of the following: Immunotechniques: ELISA, RIA. Human pathogens: Mycobacterium tuberculosis, Salmonella typhi, Bacillus anthracis, Treponema pallidum, Hepatitis virus, Candida albicans, Plasmodium, Entamoeba histolytica.

# ELECTIVE PAPER I A WATER & WASTEWATER TREATMENT 4 Credits

**Objectives:** The purpose of this course is to introduce the concept of water and waste water treatment techniques. The students learn about water resources, water treatment methods, waste water treatment and techniques for water treatment.

**Outcomes:** At the end of the course, the student is well aware on the principles involved in proper treatment of both water and waste water.

**Unit I:** Introduction: Water resources, Water demand, total requirement of water for a town & city, per captia demand, factors affecting water demand, variations in demand, design periods.

**Unit II:** Water Treatment: Importance & necessity for planned water supply, Need for water treatment, Methods for purification of water – Screening, primary settling tank, filtration & disinfection.

**Unit III:** Wastewater: Types of wastewater, Wastewater Characteristics- Physical, Chemical & Biological, Importance of improved wastewater characterization, Wastewater flow rates and constituent loadings

**Unit IV:** Wastewater Treatment: Introduction, Methods of treating domestic waste water – Screening, Primary Settling tank, Grit Chamber, Secondary & tertiary treatment of wastewater.

**Unit V:** Advanced Water & Wastewater treatment: Water – Softening, Adsorption, Desalination, Reverse Osmosis, and Wastewater - Floatation, Nitrogen & Phosphorus removal, Water Quality Standards, Guidelines for effluent discharge.

# **Reference Books:**

- 1. Fair, G.M., Geyer J.C and Okun, (2014) "Water and Waste water engineering" Vol II, John Wiley Publications.
- 2. Weber W.J., (2015) "Physico Chemical Processes for Water Quality Control".
- 3. Peavy, H.S., Rowe and Tchobonoglous, G., 2012, "Environmental Engineering", McGraw Hill
- 4. Raju, B.S.N., (2015), "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt. Co. Ltd., New Delhi.
- 5. Benefield R.D., and Randal C.W., 2011, "Biological Process Design for Wastewater Treatment", Prentice Hall, Englewood Chiffs, New Jersey.
- 6. Metcalf and Eddy Inc., (2013), "Wastewater Engineering Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

### ELECTIVE PAPER I B ENVIRONMENTAL BIOTECHNOLOGY 4 Credits

**Objectives:** The students are introduced to the biological revolutions in this field. They are taught about the microbial populations, bio-geo magnification. They learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.

**Outcomes:** The students will be able to demonstrate the use of environmental science principle in solving various environmental problems

**Unit I:** Biochemistry: Introduction, Lipids, sugars, polysaccharides, nucleotides, RNA, DNA, amino acids, proteins, hybrid biochemical, hierarchy of cellular organisms.

**Unit II:** Multiple interacting microbial populations: Neutralism, mutualism, comimensalism and amensalism. Classification of interaction between two species. Bio concentration, bio/ geo-magnification.

**Unit III:** Biotechnology: Introduction to microbial biotechnology, uses of enzymes and biomass production, isolation and purification of enzyme engineering, Sewage treatment using microbial systems, nitrogen fixing and pollutant degrading genes, biocontrol agents.

**Unit IV:** Uses of microbes: Isolating and culturing of microorganisms, production of organic compounds like, ethanol and acetone by microbial fermentation, production of enzymes by microorganism.

**Unit V:** Specific biotechnological applications to pollution control, restoration of degraded lands, free-cells and immobilized cell technology for wastewater treatment aerobic and anaerobic digestion, biogas from wastes. Bio techniques for air pollution abatement and odor control.

# **Reference Books:**

- 1. Biochemical Engineering and Fundamentals– Bailey and Ollis, (2014), Mc-Graw Hill International Edition.
- 2. A Textbook of Biotechnology– Dubey, R.C., S. Chand and Co., New Delhi. (2014).
- 3. Elements of Biotechnology Gupta, P.K., (2011), Rastogi Publications, Meerut.
- 4. Chemistry for Environmental Engineering and Science– Sawyer, C.N., Mc Carty, P.L., and Parkin, G.F., (2013),5th Edition, TMH Edition, Tata Mc Graw Hill Co. Ltd.,New Delhi.
- 5. Environmental Molecular Biology, Paul. A, Rochelle, 2011. Horizon Press.
- 6. Industrial and Environmental Biotechnology, Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, 2016. Horizon Press.
- 7. Waste water engineering treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi. 2014
- 8. Environmental Chemistry (2015), AK. De, Wiley Eastern Ltd, New Delhi.

# ELECTIVE PAPER IC AGRICULTURAL BIOTECHNOLOGY 4 Credits

**Objectives**: This course teaches the students approaches to manipulate and improve plant yield, throws light on transgenic plants. They are introduced to the concept of utilizing plants for production of vaccines and production of bio fertilizers.

**Outcomes:** These students will be able to understand the relationship between science and society and will be able to give justification for biotechnological manipulation of plants for human use

**Unit I:** Biotechnology in agriculture, growth and historical perspective of agricultural biotechnology. Agriculture biotechnology –Risks and applications.

**Unit II:** Transgenic plants resistance to biotic and abiotic stress. Transgenic plants in crop improvement. Advantages and applications of transgenic plants.

**Unit III:** Transgenic plants in quality modifications–Starch, Oil, Protein, Golden Rice, Suppression of endogenous gene, Male sterilization.

**Unit IV:** Plants derived vaccines, flower modification and color, targeting transgenic product to chloroplast and mitochondria.

**Unit V:** Biofertilizers, importance of Bio-fertilizers in agriculture (Rhizobium, Azotobacter, mycorrhiza, Actinorhiza) advantages and current status, vermi culture, composting, current practices and production of biofertilizers.

- 1. Biotechnology fundamental and application (4th edition, 2011) by S.S.Purohit.
- 2. Plant Biotechnology (2011) by B.D.Singh
- 3. Plants, Genes and agriculture (2012) by Maartein, J.Christpeels, David E.Sdava.
- 4. Crop Biotechnology (2015) by P.R.Yadav, Rajiv Tyagi.
- 5. Plant Biotechnology (2013) by Chawla.Gendel,

# 6. Steven M. Agricultural Bioethics: Implications of Agricultural Biotechnology (2015).

### ELECTIVE PAPER I D MEDICAL BIOTECHNOLOGY 4 Credits

**Objectives:** The students are introduced to the biological revolutions in this field. They are taught the role of biotechnology in the worldwide market. They learn about biosensors, vaccine production, monoclonal antibodies, nanotechnology and its applications.

**Outcomes:** The students will be able to demonstrate the use of biotechnology in solving various medical problems.

**Unit I:** Tools of Medical Biotechnology–Biotechnological revolutions- Genomics, combinatorial chemistry, insight into basic biology-Areas of application, Diagnosis and prediction of disorders Limits and approaches.

**Unit II:** Role of biotechnology in health care. World-wide market and work in medical biotechnology. Vaccine production-New developments.

**Unit III:** Biosensors in clinical diagnosis, chiral technology, monoclonal antibodies for immunotherapy.

**Unit IV:** Recent developments in medical biotechnology–Pharm for human proteins and neutraceuticals. Tissue engineering and therapeutic cloning, Application of nanotechnology in biomedical sciences- Green nano substances.

**Unit V:** Gene delivery, Drug delivery. Nanotechnology in replacing defective cells.

### Reference Books:

- 1. Fundamentals of medical biotechnology (2015) by Aparna Rajagopalan, Ukaaz publications.
- 2. Medical biotechnology (2014) by S.N.Jogdand, Himalaya publications

# ELECTIVE PAPER I FERMENTATION TECHNOLOGY 4 Credits

**Objectives:** The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine.

**Outcomes:** At the end of the course, the student will have a better appreciation for the role of microbes in industry using technology.

**Unit I:** Introduction to fermentation technology, History of fermentation, fermentation processes, Biomass, enzymes and metabolites. Process components. Batch,

continuous and fed-batch cultures. Fermenting media formulation: Carbon and nitrogen sources. Oxygen requirements and process optimization.

**Unit II:** Design and operation of Fermenters, Basic concepts for selection of a reactor, packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor.

**Unit III:** Microbial culture selection for fermentation processes: Isolation, maintenance and development of microorganisms. Starter utilization. Immobilization of biocatalysts: kinetics effects. Inactivation kinetics.

**Unit IV:** Bio-catalysis: in non-conventional media (biphasic; organic; ionic liquids; supercritical fluids).

**Unit V:** Down Stream processing. Recovery of particulate matter, product isolation, distillation, centrifugation, whole broth processing, filtration, aqueous two-phase separation, solvent extraction, chromatography and electrophoresis. Bioprocess economics. Bio product regulation. General fermentation economics.

# Reference Books:

- 1. Biely, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (2014) Megraw Hills. Rehm, H.J. and Reed G (ed), Biotechnology, Vol 1-2, Verlag chemie.
- 2. Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (2014) Pergamon Press.
- 3. Pirt, S.J. Principles of Microbial and Cell Cultivation (2014). Blackwell Scientific Publication, London.
- 4. Moo-young M. Comprehensive Biotechnology (2015). Vol. 1-4 Pergamum Press Oxford.

# ELECTIVE PAPER 1 MICROBIAL CULTURE TECHNIQUE 4 Credits

**Objectives:** The students in this course learn different types of pure culture techniques, preservation of pure culture and culture collection centers. This course also introduces the students to the different types of media and teaches about isolation of strain and improvement.

**Outcomes:** By the end of the course, the students will be able to isolate cultures in pure form and preserve cultures for further use in research studies

**Unit I:** Microbial culture techniques: Definition, Pure culture and axenic culture, Principles and methods of obtaining pure culture, Preservation of pure culture, culture collection centers.

**Unit II:** Definition and Significance of Streak plate, Pour plate, Spread plate. Single Cell isolation. Cultivation of Bacteria: Media used, Properties of good culture media.

**Unit III:** Definition, Concept, Use and Types of different culture media. Synthetic, Non- synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium. Buffers in culture medium.

**Unit IV:** Measurement and Kinetics of Microbial Growth, Scale up of microbial process. **Unit V:** Isolation of microbial products. Strain isolation and improvement. Applications of Microbial technology.

# **Reference Books**:

- 1. Bisen P.S., Varma K: Handbook of Microbiology (2011). CBS Publishers and Distributors, Delhi.
- 2. Dubey R.C. and D.K. Maheshwary, A textbook of Microbiology (2012). S Chand and Co. New Delhi.
- 3. Pelczar Michael J., Jr., E.C.S. Chan, Elements of Microbiology (2012). Mc-Graw, Hill International. Book Company, New Delhi.
- 4. Pelczar Michael J., Jr. E.C.S Chan, Noel R.Krieg: Microbiology: Concepts and applications (2011). McGraw Hill Inc.
- 5. Pelczar Michael J., Reid R.D. and Chan E.C.S.: Microbiology (2014). Tata McGraw hill publishing Co. Ltd., New Delhi.

# SKILL BASED PAPER III ADVANCE INSTRUMENTATION TECHNIQUES 4 Credits

**Objectives:** This skill based course will teach the students the various instrumentations that are used in the analytical laboratories. This course covers both fundamental and applications of the instruments that are routinely used for the characterization of biomolecules

**Outcomes:** At the end of the course, the student has the basic knowledge on the theory, operation and function of analytical instruments.

**Unit I:** NMR spectroscopy: Principle, Instrumentation, Solvents used in NMR, NMR signals in various compounds, Chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, <sup>13</sup>C NMR, 1D and 2D NMR, NOESY and COSY techniques, Applications of NMR spectroscopy.

**Unit II:** Mass Spectroscopy: Principle, Instrumentation of Mass Spectroscopy, Types of ionization like electron impact, chemical, field, FAB and MALDI, Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Tandem Mass Instruments, Applications of Mass spectroscopy **Unit III**: Chromatography: Principle, Apparatus / Instrumentation, Chromatographic parameters, Factors involved, Endpoint determination and Applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) GC-MS g) High Performance Liquid chromatography h) LC-MS i) High Performance Thin Layer chromatography k) Super critical fluid chromatography l) Affinity chromatography.

**Unit IV**: Electrophoresis: Principle, Instrumentation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis.

**Unit V**: X ray Crystallography: Production of X rays, Different X ray methods, Braggs law, Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction.

- 1. Bisen P.S., Varma K: Handbook of Microbiology CBS Publishers and Distributors, Delhi 4Pelczar Michael J., Jr. E.C.S Chan, Noel R.Krieg: Microbiology: Concepts and applications-McGraw Hill Inc.
- 2. Pelczar Michael J., Reid R.D. and Chan E.C.S.: Microbiology, Tata McGraw hill publishing Co. Ltd., New Delhi.
- 3. Powar C.B. and Daginawala H.F.: General microbiology Vol I and II Himalaya publishing house Bombay.
- 4. Prescott L.M., Harley J.P., and Klein Donald A.: Microbiology, W.M.C., Brown publishers

# **SEMESTER VI**

### CORE PAPER IX ENVIRONMENTAL BIOTECHNOLOGY 4 Credits

**Objective Objective:** The students in the course are exposed to the diversity, function, ecological adaptation of microorganisms within the environment. This course gives the importance of microbial life to key ecosystem process and teaches the role of biotechnology to address environmental issues.

**Course Outcomes:** At the end of the course, students are able to analyze case studied representatives of key areas of environmental biotechnology

**Unit I: Ecology:** Definition, scope, branches of ecology. Abiotic *factors* Water, soil, temperature, light and humidity. Animal interactions: commensalisms, mutualism, parasitism, predation, competition.

**Unit II: Ecosystem:** Definition, *structure* (biotic and abiotic components), *function* (food chain, food web, energy flow, trophic level pyramids etc), productivity, ecological succession. *Biogeochemical cycle:* Nitrogen, Phosphorous and Carbon cycles.

**Unit III: Pollution:** sources, effects and control measures of air, water, soil, noise, thermal and radioactive pollution. Pesticide impacts, eutrophication, greenhouse effect and global warming, ozone layer depletion and acid rain. Bio-accumulation and biomagnification. Biological pest control.

**Unit IV: Biodiversity:** Definition of biodiversity, types, *values of biodiversity* – productive and consumptive values. General account on uses of plant resources (food, timber, medicinal ornamental etc) and animal resources (food animals (terr restrial and aquatic), non food uses of animals, domestic livestock etc.,). Uses of microbes. Concept of hot spots and its importance. Causes of biodiversity loss. Threatened, endangered and endemic species. A general account on multilater<sub>7</sub> al treaties-CBD, IUCN, IBPGR, NBPGR, and CITES.

**Unit V: Conservation of Biodiversity:** *In situ conservation:* Biosphere, reserves, National Parks, Sanctuaries, Sacred Groves etc.,) and *Ex situ conservation* (Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperms Banks, DNA Banks. Tissue Culture and Biotechnological Strategies). Species based apr proaches - Social approaches, Chipko movement, Silent valley movement and env vironmental education. Biotechnology and intellectual property rights

- 1. Groombridge,B(Ed.)1992.GlobalBiodiversity–StatusoftheEarth'sLivingResources. Chapman & Hall, London.
- 2. UNEP, 1995, Global Biodiversity Assessment, Cambridge Univ. Press, Cambridge.
- 3. Virchow, D. 1998. Conservation & GeneticResources, Springer–Verlag, Berlin.
- 4. GaryK.Meffe&.RonaldCarroll,C.1994.PrinciplesofConservationBiology, SinauerAssociates,Inc.,Massachusetts.
- 5. Clarke, G.L. 1954, Elements of ecology, John Wiley&sons. N.Y.

- 6. Kendeigh, S.c. 1961. Animal Ecology. PrenticeHall.
- 7. Odum, E.P. 1971. Fundamentals of Ecology. W.B.Saunders company, Philadelphia.
- 8. Rastogi, V.B. and M.S. Jayaraj, 1989. Animal ecologyand distribution of
- 9. Sharma, P.D. 1990. Ecology and environment. Rasatogi publications, Meerut.
- 10. Southwick, C.H.1976. Ecology and the quality of environment. D.Van.Nostrand Co.,
- 11. VermaP.S.andV.K.Agarwal.1996.PrinciplesofEcologyS.Chand.&co.,New Delhi.

# CORE PAPER X RECOMBINANT DNA TECHNOLOGY 4 Credits

**Objective Objective:** This course teaches RDNA technology techniques and their application in the field of genetic engineering. They learn about plasmids, vectors and gain knowledge on the construction of cDNA libraries.

**Course Outcomes**: Student of this course has knowledge on gene manipulation, gene expression, which prepares them for further studies in the area of genetic engineering

**Unit I:** Restriction and Modification systems of Bacteria. Restriction enzyme, DNA Polymerases, RNA polymerase, Taq polymerase, DNA Ligase, methylase, polynucleotide kinase, alkaline phosphatase, reverse transcriptase, DNaseI, S1nuclease, RnaseH, terminal deoxynucleotidyl transferase.

**Unit II:** Plasmids: types of plasmids (F, R and Col), properties of plasmid, plasmid compatibility, copy number control. E.coli vectors-pBR322 andtheirderivatives, pUC vectors and their derivatives, BAC. Cloning in Bacillus and Streptomyces.

**Unit III:** Molecularbiologyof lambdaandLambda vectors, cosmid, phagemid,M13. Yeastvectors–YIP,YEP,YRPandYAC.Inducible promoters, selectable markersand expression vectors.

**Unit IV:** Animal vectors- SV40 Vectors, Retero viral andBaculo viral vectors, shuttlevectors. Plant vectors plasmid as gene vector, Caulimo viruses,Gemini viruses, Transposable elements as vectors Construction of cDNA and genomic DNA libraries.

**Unit V:** Probes-probe construction and labelling. Introduction of clonedgenes into cell– transformation, transduction, particlebombardment, liposome mediation, electroporation, and cocultiovation identification of recombinant DNA. Hybridization techniques- southern, Western and Northernblotting, Chromosome walking andjumping.DNA sequencing, Microarray.

- 1. Ernst.L.Winnacker,(2003)from genestoclones,2ndedition,Panimapublishing corporation, NewDelhi.
- 2. James. D. Watson (2001), Recombinant DNA technology, 2nd edition, WHF reeman and company, NewYork.
- 3. Glick and Pasternak, (1996), Molecular biotechnology, Panima publishing corporation. New Delhi.

### ELECTIVE PAPER IIA ECOTOURISM 4 Credits

**Objectives:** This course introduces the students to the basics of healthy promotion of tourism with environmental perspective.

**Outcomes:** At the end of the course, the student will be able to apply these learning to practical use.

**Unit I:** Tourism: Concepts, Definition and Historical development of tourism. Distinction between Tourist-Traveler-Visitor-Excursionist. Types and Forms of Tourism; Tourist system Nature, characteristic. Components of tourism and its characteristics.

**Unit II:** Domestic and International tourism: Domestic tourism: features, pattern of growth, profile. International tourism: Generating and Destination regions. Pattern of growth and Profile.

**Unit III:** Places of interest of ecotourism: Wildlife Sanctuaries (Bharatpur Bird Sanctuary, Biligiri Rangaswamy Temple), National Parks (Jim Corbett Tiger Reserve, Kanha NP, Kaziranga NP, Gir NP,) and Biospehere reserves in India (Nilgiri BR, Sunderbans BR, Seshachalam Hills BR). Hill Stations: Study of Hill Station attractions and their environs with case studies of Mussoorie, Nainital, Munnar and Ooty. Beaches: Beaches in Goa, Kerala, Orissa. Islands: Andman Nicobar & Lakshdvip islands.

**Unit IV:** Tourism Impacts: Positive and Negative Impacts of Tourism: Socio - cultural, Economic, Environmental and Political. Factors affecting ecotourism impacts, Ecotourism as a tool for sustainable development.

**Unit V:** Ecotourism related organizations: History, objectives and role of UNWTO, WTTC, TAAI, IATO, IATA, and ITC in promoting ecotourism, Role of environmental education in ecotourism.

# **Reference Books:**

- 1. Bhatia. Tourism Development, 2000, New Delhi, India
- 2. Seth: Tourism Management, 2000, Pune, India
- 3. Kaul: Dynamics of Tourism, 1999, New Delhi, India.
- 4. Mill and Morrison The Tourism system an Introductory Text (2000)) Prentice Hall
- 5. Cooper, Fletcher, Tourism, Principles and practices (1999) Pitman
- 6. Burkart and Medlik Tourism, Past, Present and Future (1981) Heinemenn, ELBS.
- 7. P.S. Gill, Dynamices of Tourism (4 Vols) Anmol Publication.
- 8. P.C. Sinha, Tourism Management. Anmol Publication. 1999
- 9. P.C. Sinha, Tourism Evolution Scope Nature & Organization. Anmol Publication.

# ELECTIVE PAPER IIB ENVIRONMENTAL TOXICOLOGY 4 Credits

**Objectives:** This course is designed to impart the basics in toxicological aspects that effect the environment. The students learn about toxicology, chemical carcinogenesis, epidemiology and environmental health.

**Outcome:** The outcome of this course is to provide the necessary knowledge to the students to understand the basic toxicological aspects

**Unit I:** Basic Definitions and Terminology, Concept, Importance and the Dose–Response Relationship, Factors Influencing Dose–Response Curves, Descriptive Toxicology: Testing Adverse Effects of Chemicals and Generating Dose–Response Data, Extrapolation of Animal Test Data to Human Exposure

**Unit II:** Toxicology and safety, Transfer across Membrane Barriers, Absorption, Distribution, and Elimination of Toxic Agents, Sites of Biotransformation, Biotransformation Reactions, Hematotoxicity: Basic Concepts and Background, Direct Toxicological Effects of CO<sub>2</sub>, Inorganic Nitrates/Nitrites and Chlorate Salts.

**Unit III:** Chemical Carcinogenesis: Terminology of Cancer, Carcinogenesis by Chemicals, Molecular Aspects of Carcinogenesis, Testing Chemicals for Carcinogenic Activity, Occupational Carcinogens, Cancer and Our Environment

**Unit IV:** Properties and Effects of Metals: Classification of Metals, Speciation of Metals, Pharmacokinetics of Metals, Toxicity of Metals, Sources of Metal Exposure, Toxicology of Selected Metals-Fe, Hg, Pb, Ar, Cr, Properties and Effects of Pesticides: Organophosphate and Carbamate Insecticides

**Unit V:** Epidemiology and Environmental Health: History of Epidemiology, Epidemiologic Causation, Types of Epidemiologic Studies: Advantages and Disadvantages, Exposure, Disease and Human Health Effects, Measurement of Disease or Exposure Frequency

# **Reference Books:**

- 1. Phillip L. Williams, Robert C. James, Stephen M. Roberts, Principles of Toxicology-Environmental and Industrial Applications (2nd Edn.), AWiley-Interscience Publication, Johnwiley & Sons, Inc. 2014.
- 2. John H. Duffus, Howard G. J. Worth, Fundamental Toxicology, Published by The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF, UK. 2015

# ELECTIVE PAPER IIC BIO- PROCESSING & SEPARATION 4 Credits

**Objectives:** The course introduces the analytical methods used in separation science. They learn about various analytical techniques that are routinely used for separation of biomolecules and their components

**Outcomes:** The course teaches students the advantages of separation science as applied to biotechnology.

Unit I. Classification of Bioproducts: Small molecules, Macromolecules-Pro-

teins, Nucleic acids and nucleotide, Polysaccharides, Engineering analysis.

**Unit II: Analytical methods:** Biological activity, Analysis of purity-Electrophoresis, HPLC, HPLC-Mass Spectrophotometric assay, Microbiological assays.

**Unit III: Cell lysis and Flocculation:** Cell structure- Prokaryotic cells, Eukaryotic cells, Cell lysis- Chemical and mechanical methods, Flocculation- Electric double layer, Flocculation rate.

**Unit IV:** Filtration: Filtration principles- Conventional and crossflow filtration, filter media and equipment, membrane fouling, scaleup and design of filtration system.

**Unit V:** Equation of motion, Equilibrium sedimentation, Sedimentation coefficient, Equivalent time, Production centrifuge, Ultracentrifugation. Sedimentation at low acceleration, partitioning equilibria, Phase separation, Countercurrent stage calculation, scale up and design of extractors.

### **Reference Books:**

- 1. Bioseparation and Bioprocessing: A Handbook, 2 Volume Set (2012). Ganapathy Subramanian (Editor) Wiley publishers.
- 2. Introduction to Environmental Biotechnology- A K Chatterji (2011). Edition 2<sup>nd</sup>.

# ELECTIVE PAPER II D BIOTECHNOLOGICAL APPLICATION IN WASTE WATER MANAGEMENT 4 Credits

**Objectives:** The objective of this course is to introduce the students to the role of biotechnology in waste water management. The students learn about role of microbes in biodegradation, bioremediation and composting.

**Outcomes:** At the end of the course will be able to understand the treatment processes of waste water and also the knowledge of production of biogas.

**Unit I:** Historical introduction to water and waste water environment. Domestic and industrial waste water flow rate and characteristics. Design of waste water network, waste water treatment process. Biotechnology in Environment & Biodiversity: Waste Water Treatment, Biodegradation, Bioremediation, composting, Solid waste Management, chemical degradation, heavy Metals. Biofuel- Biodiesel, Biogas, Ethanol.

**Unit II:** Microorganisms & Agriculture – Microorganisms in Agricultural Waste water treatment, vermiculture, Microbial pesticides.

**Unit III:** Environmental Management – Concept of health and sanitation, environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases, health hazards due to pesticide and metal pollution, waste treatment, solid waste management.

**Unit IV:** Secondary classification, advanced treatment process – Granular media filtration, Absorption. Chemical treatment, air stripping and ammonia removal. Waste water disinfectant. Diffuses from waste water – plume flow, design. Treatment of waste water in Food processing, Paper, Sugar and Leather industry.

**Unit V:** Soil Tests, Percolation test, Aerobic digestion, anaerobic digestion, composting, Sludge disposal.

# **Reference Books:**

- 1. Purohit by Introduction to Biotechnology- Brown, Campbell, Priest- Panima Publications (2011)
- 2. Biotechnology by U Satyanarayana- New Age publications (2011).
- 3. Biotechnology by B.D. Singh, Kalyani Publications (2012)
- Biotechnology: Expanding Horizone- B.D. Singh- Kalyani Publications. (2012)
- 5. A Text book of Biotechnology R.C. Dubey- S. Chand (2014).
- 6. Advances in Biotechnology- S.N. Jogd and- Himalaya Publication (2012).

# ELECTIVE PAPER IIE BIOETHICS & BIOSAFETY 4 Credits

**Objectives:** This course is an introduction to the students on the ethical aspects of conducting research and safety aspects to be adhered in a research setting. This course also introduces the students to effective management of available resources and footprint of research activities.

**Outcomes:** At the end of the course, the student would have gained sufficient knowledge to act as a responsible scientist and environmentally conscious.

**Unit I:** Definition of ethics and Bioethics: Ethics in Biotechnology (positive and negative effects with classical examples–Rice with Vitamin A. No till Agriculture, cotton without insecticide, reduced need for fertilizer, biological pest control, slow ripening fruits and controlled ripening, fast growing trees and fishes.

**Unit II:** Awareness education on genetically engineered organism.-Transgene instability, gene flow, resistance/ tolerance of target organism, increase weed less ness, risks and uncertainty associated with biotechnology.

**Unit III:** Containment levels and their impact on Environment- Containment-definition, types of containment, summary of recommended Biosafety levels for infectious agents, detail checklist–premises and lab equipment, Animal facilities, environment.

**Unit IV:** Gene technology laboratory. GLP and Bioethics-introduction, national Good Laboratory Practices (GLP), the GLP authority functions, Good Laboratory Practices-necessity, aspiration and responsibility.

**Unit V:** Ethics in clinical trials and Good Clinical Practices (GCP) Definition of clinical trials and GCP, general information about clinical trials, need to conduct clinical trials, faces of clinical trials, institutional set ups for conducting clinical trials, ethics in clinical biotechnology.

- 1. Safety Assessment by Thomas, J.A., Fuch, R.L. (2002), AcademicPress.
- Biological safety Principles and practices) by Fleming, D.A., Hunt, D.L., (2000).ASM Press.

- 3. Biotechnology- A comprehensive treatise. Legal economic and ethical dimensions VCH. Bioethics by Ben Mepham, Oxford University Press, 2005.
- 4. Bioethics & Biosafety by R Rallapalli & GeethaBali, APH publication, 2007
- 5. Bioethics& Biosaftey By Sateesh Mk (2008), IkPublishers
- 6. Biosafety And Bioethics Rajmohan Joshi Publishers

# ELECTIVE PAPER IIF MICROBIAL DISEASES CONTROL 4 Credits

**Objectives**: This course is designed to impart knowledge on infectious disease epidemiology, investigating the outbreak and the role of public health laboratories in disease surveillance. The students are taught on the various infectious diseases, mode of transmission and different evaluation and control strategies. The students would also be able to appreciate behavioral changes in HIV patients, blood safety and immigrant health.

**Outcomes:** The student at the end of the course will be able to gain knowledge about vaccination, screening of various diseases and modeling infectious disease data.

**Unit I:** General principles of infectious disease epidemiology, including: Principles of Infectious Diseases; Outbreak Investigation.

**Unit II:** Role of the Public Health Laboratory; Disease Surveillance; Modeling Infectious Disease Data, Principles of Screening and Screening Tests.

**Unit III:** Major infectious diseases and modes of transmission, including: Food borne Illness; Zoonotic Diseases; Tuberculosis; Influenza; Vector-Borne Diseases; Malaria; Other Parasitic Diseases; HIV/AIDS; Sexually Transmitted Diseases; Viral Hepatitis; Antibiotic Resistant Bacteria.

**Unit IV:** Different control and evaluation strategies for infectious diseases, including: Vaccination; Nosocomial Infections.

**Unit V:** Behavior Change and HIV/STDs; Blood Safety; Immigrant and Refugee Health; International Research in Resource Poor Settings; Critical Reading of Medical Literature.

# Reference Books:

- 1. "Infectious Disease Epidemiology", Second Edition, edited by Kenrad Nelson and Carolyn Williams. Jones and Bartlett, 2007.
- 2. "Control of Communicable Diseases Manual", 19th Edition, edited by David L. Heymann. American Public Health Association, 2008
- 3. Riegelman, R. (2010) Public Health 101: Healthy People Healthy Populations, Sudbury, Massachusetts: Jones and Bartlett Publishers.
- 4. Pfizer. (2006). Milestones in Public Health: Accomplishments in Public Health over the Last 100 Years. New York: Pfizer Global Pharmaceuticals
- 5. Pfizer. (2003). Advancing healthy populations: The Pfizer guide to careers in public health. New York: Pfizer Global Pharmaceuticals
- 6. Pfizer. (2007). Moments in Leadership: Case studies in Public health Policy and Practice. New York: Pfizer Global Pharmaceuticals

# ELECTIVE PAPER IIIA SOLID WASTE MANAGEMENT 4 Credits

**Objectives:** This course introduces the students on the various methods available for solid waste management. The course covers topics on composition, properties, transportation, separation, transfer and recycling of solid waste.

**Outcomes:** At the end of the course, the students will be able to appreciate all the aspects involved in solid waste creation, minimization and complete environmentally safe method of their disposal.

**Unit I:** Introduction: Definition, Sources – household, street, demolition, construction. Composition and Properties of Municipal Solid Wastes. Legislation and its impact.

**Unit II:** Engineering principles: Generation rates, Collection, waste handling and separation, storage and processing at the source.

**Unit III:** Collection, transfer and transportation: Types, equipment, personnel requirements, analysis & collection system, collection routes, types of transfer

stations, transport means and methods.
<b>Unit IV:</b> Separation, transformation and recycling: Unit operations for separation and processing, size reduction, separation, density separation, fundamentals of thermal processing – combustion, pyrolysis, gasification, energy recovery system.
<b>Unit V:</b> Biological and chemical conversion technologies: Principles, Aerobic &, anaerobic composting and energy recovery. Incineration - Process, Types, Heat Recovery, Incineration Products, Air Pollution Control
Reference Books: 1. George Tchobanaglous, Hilary Theissen and Samuel A. Vigil, (2013), Integrated Solid Waste Management: Engineering Principles and Management Issues-, McGraw-Hill Science Engineering. 2. Bhide and Sundaresan (2015), Solid Waste Management in Developing Countries, Indian National Scientific Documen-
tation Centre. New Delhi. 3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (2016), Environmental Engineering, McGraw Hill Publishing company,
New Tork. 4. Sincero, A.P., and Sincero, G.A., (2018), Environmental Engineering – A Design Approach, Prentice- Hall of India Pvt.
5. Sasikumar K and Krishna S. G., (2016), Solid Waste Management, PHI Learning Pvt. Ltd., New Delhi.
ELECTIVE PAPER IIIB HYDROLOGY 4 Credits
<b>Objectives:</b> This course introduces the students on the various methods available for solid waste management. The course covers topics on composition, properties, transportation, separation, transfer and recycling of solid waste.
<b>Outcomes:</b> At the end of the course, the students will be able to appreciate all the aspects involved in solid waste creation, minimization and complete environmentally safe method of their disposal.
<b>Unit I: Introduction:</b> Definition of hydrology, Importance of hydrology, Practical applications of hydrology, Global water avail- ability, Water resource availability in India's. Water consumption pattern, Impacts of over exploitation of water.

	<b>Unit II: Ground water hydrology and well hydraulics:</b> Scope and importance of ground water hydrology. Water bearing geological formations, Rock properties affecting ground water, ground water basins, springs, Aquifers - Definition, Types of aquifer, properties of aquifer, Vertical distribution of ground water.
	<b>Unit III: Hydrological cycle</b> <i>Precipitation:</i> forms and types of precipitation. Measurement of precipitation (recording and non-recording type), Annual rainfall in India, Evaporation: Definition, Process, factors affecting evaporation, transpiration evaportanop, reducing evaporation, transpiration evaportanop, reducing evaporation from water bodies, Infiltration: Definition, factors affecting infiltration, infiltration capacity, Measurement of infiltration.
	sion, water resources projects in India, advantages and disadvantages of water resources projects, Water resources manage- ment in India with special reference to Karnataka.
	<b>Unit V: Rainwater harvesting:</b> Definition, need, objectives, elements and types of rainwater harvesting, Methods of ground water recharge, Advantage and limitations of rain water harvesting, Case study of rain water harvesting, traditional rain water harvesting.
	<ul> <li>Reference Books:</li> <li>1. Subramanya K, (2008), Engineering Hydrology Tata McGraw Hill, New Delhi.</li> <li>2. Jaya Rami Reddy, (2005) A Text Book of Hydrology, Laxmi Publications, New Delhi.</li> <li>3. H.M. Raghunath, (2009), Hydrology-Principle analysis and design, Wiley Eastern Publication, New Delhi.</li> <li>4. Ven Te Chow, Larry W. Mays, David R. Maidment, (1988), Hand Book of Hydrology, McGraw Hill.</li> <li>ELECTIVE PAPER IIIC: GENOMICS &amp; PROTEOMICS</li> <li>A. Chow, Larry W. Mays, David R. Maidment, (1988), Hand Book of Hydrology, McGraw Hill.</li> <li>4. Ven Te Chow, Larry W. Mays, David R. Maidment, (1988), Hand Book of Hydrology, McGraw Hill.</li> </ul>
	<b>Objectives:</b> This course aims to provide the knowledge and practical skills of functional genomics and proteomics. The course also teaches the techniques used in functional genomics such as microarrays, NGST, mRNA expression and miRNA expression.
	<b>Outcomes:</b> By the end of the course, students will have the necessary learning to radically advance our understanding of life and transform medicine
163	<b>Unit I:</b> Introduction to genome data bases-data base search-Algorithm issues in databases search- sequence database search- FASTA-BLAST-Types of genomic data bases and uses: Polymorphic markers, Cytogenic Maps, LINE, SINE-Amino acid substitu-

tion matrices PAM and BLOSUM.
<b>Unit II:</b> Gene Therapy: Concept and Principles of Gene Therapy. Principles of gene Expression-Genome Mapping-physical and genetic mapping techniques, Human Genome Project- Genomes of other organisms. Shotgun DNA sequencing – Sequence assembly-Gene predictions-Molecular prediction with DNA strings.
<b>Unit III:</b> Genomic resources, Gene structure and DNA sequences. EST comparison, gene hunting. Expression analysis SAGE, cDNA library, ORF prediction, Microarray –DNA sequencing and sequence alignment: RFLP, SNP, RAPD, Application of Comparative Genomics.
<b>Unit IV:</b> Protein database: CATH, SCOP, FSSP, SARF, MM. Protein structure and comparison, Blocks, Class, Domain, Fold, Pro- file, Motif and PSSM.
<b>Unit V:</b> Structural Proteomics: Experimental Techniques for Protein Structure Elucidation, X-ray Crystallography, 2-D Electro- phoresis- Sample preparation, pH gradient-MALDI-TOF, Electro plot, Protein Microarrays and Bio-separation. Metabolomics: Understanding the Metabolic Pathways of Microbes, metabolic pathway databases - KEGG. Structure prediction, active site determination, neural networks. Protein-protein interaction, protein-DNA interaction. Enzyme Substrate interac- tion. Applications of Proteomics: Plant breeding and Biomedical.
<b>Reference Books:</b> <ol> <li>Introduction to bioinformatics by Dr. Mani andDr. Vijayaraj. Wiley Publisher</li> <li>Bioinformatics by Parry and Smith (2005). Wiley Publisher</li> <li>Bioinformatics by David Mount. Wiley Publisher</li> <li>Genomes 3 by T. A.Brown. Wiley Publisher</li> <li>Proteomics-Pennigton &amp; Dunn (2002) Viva books publishers, New Delhi</li> </ol>

# ELECTIVE PAPER-IIID INDUSTRIAL BIOTECHNOLOGY 4 Credits

Objectives: The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine

Outcomes: At the end of the course, the student will have a better appreciation for the role of biotechnology in industry using microbes Unit I: Fermenter-batch and continuous fermenter, general design of a stirred tank fermenter, sterilization and maintenance of sterile conditions. **Unit II:** Preparation of inoculums, Types of fermentation- solid state fermentation- tray and drum, and submerged fermentation-batch and fed batch, Media used for industrial fermentation. Unit III: Microbial production and product recovery-Alcoholic beverage-wine and beer. Production of vinegar from alcohol, production of vitamin- B12, production of organic acid-lactic acid and glutamate. Unit IV: Fermented dairy products-microorganisms involved in fermentation, yogurt, curds, sour cream, cheese paneer, pickles, idly, single cell protein. **Unit V:** Starting an Enterprise: Entrepreneur, business idea, Management, Marketing and Financial Planning.

- 1. Industrial Microbiology, Prescot and Dunn, 2015
- 2. Biochemical Engineering and Biotechnology Handbook, Atkinson, Band Marituna, F., the Nature Press, Macmillan Publisher 2015.
- 3. Biochemical Engineering Fundamentals (2014), Bailey&Olis.MGH.
- Text book of Biotechnology– Plant Biotechnology and industrial biotechnology (2014) by S.B. Sullia, G. SivaKumarSwami, P.A. Sastry-United publishers

# ELECTIVE PAPER IIIE

# VERMICULTURE TECHNOLOGY 4 Credits

**Objectives:** This course teaches about earthworm biology and role of earthworm in soil in association with microorganism. They also study the different earthworm species used in vermi-compost production and importance of vermicompost in organic farming.

**Outcomes:** At the end of the course, the students will be able to use vermicomposting as a tool for solid waste management, organic farming and be able to set up small-scale industry.

**Unit I:** Soil biota -Earthworms -Ecological classification of earth worms as Epigamic. Introduction to earthworm biology -physical and chemical effects of earth worms on soils.

**Unit II:** Role of earthworms in soil -classification of earthworms based on ecological strategies- Burrowing activity of earthworms- Drilospheres -Microorganisms and their relationship with earthworms.

**Unit III:** Composting -anaerobic composting, aerobic composting, types of composting, vermi-compost- earthworm species used in vermi-compost production - endemic species, exotic species.

**Unit IV:** Vermi compost -setting up vermi compost quality N, P, K, C, N, Microbial quality applications –vermi-culture –vermi wash - role of vermi compost in organic farming - its quality and advantages over chemical inputs.

**Unit V:** Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions. Vermicomposting as a tool for solid waste management - a small scale industry.

- 1. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
- 2. Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London Ismail, S.A., 1997, Vermicology: The Biology Earth worm Orient Longman
- 3. Kale Radha, D 1998. Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore.
- 4. Satchell, J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London Stephenson J, 1923. The fauna of British India -Oligo.
- 5. Satchell, J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London StephensonJ., 1923. The fauna of British India -Oligo.

# **ELECTIVE PAPER IIIF**

# BIOPESTICIDE & BIOFERTILIZER 4 Credits

**Objectives:** The aim of this course is to introduce the students to the role of bio-pesticides and bio-fertilizers in enhancing the fertility of soil. The students also learn about the large scale production of bio-fertilizers and bio-pesticides and their mechanism of action and application.

**Outcomes:** By the end of the course, the student will be able to gain knowledge about their commercialization.

**Unit I:** Biofertilizers – Definition, kinds, microbes as biofertilizers, Symbiotic associates – Rhizobium taxonomy, Physiology, Host cell – Rhizobium interactions, inoculants and mass cultivation.

**Unit II:** Frankia woodland and Actinornizal nitrogen fixing plants and its host plants, characteristics, identification, cultural method and maintenance of Azospi-rillum, Azotobacter, Azolla and anabaena.

**Unit III:** Mycorrhiza - VAM association, types, occurrence, Collection, isolation and inoculum production.

**Unit IV:** Large scale production of biofertilizer, Organic farming Carrier materials, general outline of microbes as fertilizers, Rhizosphere effect microbial products influencing plant growth.

**Unit V:** Biopesticides – Definition, kinds and commerce of biopesticide, Bacillus thuringiensis, insect viruses and entomo-pathogenic fungi – its characteristics, physiology, mechanism of action and application.

### **Reference Books**:

- 1. Subba Rao, N.S. 2000 Soil Microbiology. Oxford and IBH Publishing Co. Ltd.
- 2. Verma A and Hock B. 1995. Mycorrhiza.
- 3. Yaacovokan, 1994 Axospirillum, CBC press.
- 4. Wicklow, D.T. and B.E. Soderstrom. 1997, Environmental and microbial relationships. Springer.

# **BSc. Food Nutrition and Dietetics**

### **Course Overview**

This program utilizes expert faculty from various Food Science and Nutrition, Clinical Nutrition, Nutrition and Dietetics, Research Institutes and Food industry.

Nutrition science is the study of nutrients that are essential for growth, development and maintenance of good health throughout life. In the present scenario, society needs the awareness regarding their diet and also, people are becoming more nutrition conscious. The common man is gradually switching towards nutrition scientists and dietitians for scientifically proved information on Nutrition and Dietetics. This interest in the society to gain knowledge on diet planning can lead to have a healthy life and especially in preventing the development degenerative diseases.

Criteria for designing the balanced diet were to fulfill the nutritional requirement and to overcome the nutritional deficiencies. Currently the barrier is extended towards designing the diet for therapeutic nutrition (Neutraceuticals) which is the need of the hour.

Food industry is now focusing more on nutrient composition and information of food products on label. In market many types of foods are available for all age groups and try to fulfill the requirements of people with different physiological status. Print and electronic media pour out nutrition messages to the public.

Hence it is essential that Nutrition and Dietetics is offered at various levels of education in general and in masters in particular. Here the student learns both the rudimentary and application aspects, which includes the investigation and analysis of the requirement along with the skills. Candidates pursuing the course can practice as nutritionists and dieticians in different hospitals, fitness centers, food industry, R and D institutes etc.

			SEMESTER I				
				Hrs/	Deemed to be Univ		
Part	Study Compo- nents and Code		Paper	week Dur. in Hours	CIA	Theory/prac- tical Exam	
Ι	Part I		English I	6	3	25	
II	Part II		English I	6	3	25	
III	Core Pape	er I	Introduction to Food and Nutrition	4	3	25	
	Core Prac	tical I	Food Science	4	3	25	
	Allied I		Basics of Biostatistics	3	3	25	
	Allied Pra	ctical I		3			
IV	Environm Studies	ental	Environmental Studies	2	2	25	
			S	EMESTER II			
I	Part I		English II	6	3	25	
II	Part II		English II	6	3	25	
III	Core pape	er II	Applied Physiology	4	3	25	
	Core Prac	tical II	Physiology and Hematol- ogy	4	3	25	
	Allied II		Principle of Biochemistry	3	3	25	
Allied Practical I & II		ctical I &	Biostatistics and bio- chemistry	3	3	25	
			S	EMESTER III			
I		Part I ENG	English III	6	3	25	
II		Part IIENG	English III	6	3	25	
III		Core Pa- per III	Public Health Nutrition	4	3	25	
		Core Pa- per IV	Principles of Human Nu- trition	4	3	25	
		Core Practical III	Assessment of Nutrition- al Status	3		25	
		Allied III	Bioinformatics	3	3	25	
		Allied Practical III		3			
IV		Skill based I	Basics of Computers	3	3	25	

# BSc Food, Nutrition and Dietetics Examination Scheme

				1	1	1	1
	SEMES	TER IV			6	2	25
	1		Part I	English IV	6	3	25
ersity Exa	amination				6	3	25
Max. Marks	III	Total Credit	core Pa- per V	Dietetics	4	3	25
Piarks			Core	Distation			<b>a</b> -
75	100	4	Practical	Dietetics	4	3	25
75	100	4	Allied IV	Fundamentals of Nano-	3	3	25
/ 5	100			Bioinformatics & Nano-			
75 50	100 75	4 3	- Practical	technology	3	3	25
25	IV	2	Skill based II	Tissue Culture	3	3	25
25	-50	2					
	<b>SE</b> MES	TER V				1	1
			Core pa-	Food Preservation and		_	25
75	1 <del>0</del> 0	4	per VI	adulteration	4	3	25
75	100	4	Core pa-	Mool planning	1	2	25
75	100	4	per VII		4	5	23
75	100	4	Core Pa-	Food Service Manage- ment	4	3	25
50	75	3	Core	Core Food Preservation and ractical Adulteration	4		25
25	50	2	practical V			3	
	525	21		Sanitation and Hygiene			
			Elective I	Nutwition and enoute and	4	3	25
75	100	4		fitness			
75	100	4	based subject	Advanced Instrumenta- tion Techniques	3	3	25
75	100	4					
75	100	4					
	SEMES	TER VI	_			1	
75	100	4	Core Pa- per IX	Nutraceuticals	4	3	25
50	75	3	Core Pa-	Food Microbiology	4	3	25
			Core practical VI	Food Microbiology	4	3	25
75	100	4					

	Elective II	Food packaging Food Product Develop- ment and Quality Control	4	3	25
	Elective III	Food toxicology Food analysis	4	3	25
V	Exten- sion ac- tivities				
Total( Semester I to VI)					

			Syllabus
75	100	4	PART I. ENGLISH I
	Objectiv	es: These	e courses are designed to develop the communication and vo-
	cabulary	<del>skills in tr</del>	ie students
75	100 Outcome edge for	4 es: Upon profession	completion of the course, the students have sufficient knowl-
	<b>URITI</b>	a <del>3</del> sages 1	to 5.
	USISIO II.	222 Orrect	Use of Nouns and Correct Use of Pronouns
	3500 Unit III.	140 Correct L	Ise of Adjectives and Correct use of the Verb

**Unit IV**. Roots (A to F)

**Unit V**. Roots (G to N)

# PART II. ENGLISH I

**Unit I**. Passages 1 to 5

**Unit II**. Poems: "When in Disgrace" by Shakespeare; "Daffodils" by William Wordsworth; "Obituary" by A K Ramanujan

**Unit III.** Prose: The Ultimate Safari" by Nadine Gordimer and "The Gift of the Magi" by O 'Henry

**Unit IV.** Poems: "Because I Could Not Stop for Death" by Emily Dickenson; "After Apple Picking" by Robert Frost and "Sonnet – The Lotus" by Toru Dutt.

**Unit V.** Prose: "The Face on the Wall" by E V Lucas and "Kabuliwala" by Rabindranath Tagore

### ಮೊದಲನೇ ಸೆಮಿಸ್ಟರ್

### ಪತ್ರಿಕೆ- 1: ಸವಿಸ್ತರ -ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 1

ಭಾಗ –	1		<b>0</b> –
ಪದ್ಯಗಳ	ಓದು ಮತ್ತು ವ್ಯಾಖ್ಯಾನ		
1.	ಕನ್ನಡಿಗರ ತಾಯಿ	:	ಗೋವಿಂದ ಪೈ
2.	ਰਹਾਹਿਰ	:	ಬಿ.ಎಂ.ಶ್ರೀಕಂಠಯ್ಯ
3.	ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ	:	ಕುವೆಂಪು
4.	ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ	:	ದ.ರಾ.ಬೇಂದ್ರೆ
5.	ರಂಗವಲ್ಲಿ	:	ಮ.ತಿ.ನರಸಿಂಹಾಚಾರ್
6.	ಸಂಬಳದ ಸಂಜೆ	:	ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
7.	ಯಾವ ಹಾಡ ಹಾಡಲಿ	:	ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
8.	ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ	:	ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ
9.	ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ	:	ನಿಸಾರ್ ಅಹಮದ್
10.	ಅನಾಥೆ	:	ಸುಕನ್ಯಾ ಮಾರುತಿ
11.	ನೀವೆಲ್ಲಿಯವರೋ	:	ಜಂಬಣ್ಣ ಅಮರಚಿಂತ
12.	ಯುದ್ಧ	:	ಸವಿತಾ <sup>¨</sup> ನಾಗಭೂಷಣ

### ಭಾಗ – 2

ಗದ್ಯ	ಭಾಗ – ಪ್ರಬಂಧಗಳು		
1.	ಗರುಡಗಂಬದ ದಾಸಯ್ಯ	:	ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
2.	ದೇವರು ಮತ್ತು ಪುನರ್ಜನ್ಮ	:	ಎಚ್.ನರಸಿಂಹಯ್ಯ
3.	ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ	:	ಪಿ.ಲಂಕೇಶ್
4.	ಮೊಬೈಲ್ ಠೇಂಕಾರದ ಜೇನ್ನೊಣಗಳ ಝೇಂಕಾರ	:	ನಾಗೇಶ್ ಹೆಗಡೆ
5.	ಆಗಸ್ಟ್ –6 – ಶಾಂತಿದಿನ – ಶ್ವೇತಭವದನದ	:	ನೇಮಿಚಂದ್ರ
	– ಮುಂದೆ 20 ವರ್ಷ		

### ಭಾಗ – 3

ಆಡಳಿತ ಕನ್ನಡ

- 1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ, ಸ್ವರೂಪ, ಲಕ್ಷಣ
- ಆಡಳಿತ ಕನ್ನಡ ಬೆಳೆದು ಬಂದ ದಾರಿ (ಆಡಳಿತ ಕನ್ನಡದ ಇತಿಹಾಸ) 2.

### ಭಾಗ – 4

ಆಡಳಿತ ಕನ್ನಡ – ಪ್ರಾಯೋಗಿಕ ಬರವಣಿಗೆ

- 1. ಸರ್ಕಾರಿ ಪತ್ರದ ವಿವಿಧ ಅಂಗಗಳು ಮಾದರಿಯೊಡನೆ
- 2. ವಿವಿಧ ಸರ್ಕಾರಿ ಪತ್ರಗಳು
  - ಅಧಿಕೃತ
  - ಅರೆ ಅಧಿಕೃತ
  - ಅಧಿಕೃತ ಜ್ಞಾಪನ
    ಸುತ್ತೋಲೆ

ಭಾಗ – 5 ಪದ್ಯಗಳ ಮರುವ್ಯಾಖ್ಯಾನ ಮತ್ತು ವಿಮರ್ಶಾತ್ಮಕ ಚರ್ಚೆಗಳು

### CORE PAPER 1. Introduction to Food and Nutrition 4 Credits

**Course Objectives:** The course illustrates about the rols of food and nutrition on health. It imparts knowledge about functions of carbohydrates, proteins and minerals/vitamins on health.

**Outcomes:** The course will support students in understanding basic knowledge about the food quality and health effects. They will also learn about the role of water balance in maintaining the physiolocial state of the body.

**Unit I. Introduction to Nutrition & its terminology:** Introduction to Nutrition-Terms used in Nutrition and Health. Definitions-Health, Nutrition, Nutrients, Foods, Diet, RDA., Balanceddiet, Malnutrition, Under nutrition, Over nutrition, Optimum nutrition. Five Food Groups and Food guide, relationshipbetween food and nutrition, functions of food, classification of nutrients, factors affecting food consumption and food acceptance.

**Unit II**. **Water and Energy**: Basic of nutrition: Water - Functions, sources, requirements, water, balance, dehydration (ORS) and toxicity, water as a cooking medium, effects of hard and soft water on cooking. Energy - unit of energy, food as a source of energy, definition of calorie and joules, energy requirement and factors affecting it- BMR, RMR, SDA, growth and development, activity, effects of deficiency and excess.

**Unit III: Carbohydrate, Lipids, and Proteins:** Carbohydrate- Composition and classification, source, functions. Lipids- composition, sources, functions, requirements, deficiency and excess; fatty acids- essential and non-essential, SFA, USFA, MUFA, PUFA, significance of fatty acids. Proteins - composition, classification (complete, incomplete), sources, functions, requirements, deficiency, nutritional classification of amino acids (essential, Non-essential, semi-essential), mutual supplementation.

**Unit IV: Minerals and Vitamins**: Minreals- distribution in body, functions and sources, bioavailability and requirement, deficiency and excess of the following. Factors affecting (enhancing/ inhibiting) absorption. Vitamins - classification, sources, functions, requirements, deficiency and excess of the following, Factors affecting availability of vitamins from the diet.

**Unit V: Food adulteration, weights & measures of foods:** Methods & medium of Cooking. Food Adulteration and Food Laws- Definition, Types, Common adulterants and home scale methods of detecting adulterants; Food Laws (only introduction) – PFA, BIS, AGMARK, FPO, HACCP. Introduction to weights and measure, Learn to weigh food ingredients, introduction to variousmeans of measurement, method to measure fruits/ vegetables. Methods and medium of cooking, Various methods of cooking (with examples of recipes), Advantages/ disadvantages of various methods, Food Guide and RDA - Introduction of food guide, its uses, RDA, Reference Man and Reference Woman.

# **Reference Books:**

1. Srilakshmi. B. Food Science, New Age International (P) Ltd. Publishers, Sixth edition. 2016..

- 2. Mudambi, S.R., Rajgopal, M.V.(1990) Fundamentals of Foods and Nutrition, New Age International Pvt. Ltd.
- 3. Nutrient Requirements and Recommended Dietary Allowances for Indians-I.C.M.R.Publication.2014.
- 4. Elenaor N., Whitney S., Rady R. (1993): Understanding Nutrition, West Publishing Company, Minneapolis.
- 5. Blank F.C. (2011): Handbook of Food & Nutrition, Ago Botanical Publishers, Bikaner.

# Practical 1 Food Science 4 Credits

- 1. Study the effect of temperature, time of heating, concentration, addition of sugar and acid on gelatinization of starch.
- 2. Prepare recipes using the following processes- Gelatinization, gluten formationand gel formation.
- 3. Demonstrate the effect of soaking, hard water, sodium bi carbonate and papayaon cooking quality of pulses.
- 4. Prepare recipes using whole gram, dhal, pulse flours, sprouted pulses and cereal pulse combination.
- 5. Demonstrate the factors affecting coagulation of milk protein and prepare milk products.
- 6. Demonstrate the formation of ferrous sulphide in boiling egg and its preventivemeasures.
- 7. Demonstrate the effect of addition of acid, fat, salt, water and sugar on the texture of omelets.
- 8. Prepare recipes where egg acts as thickening agent, binding agent, emulsifying agent and enriching agent.
- 9. Demonstrate the effect of acid, alkali and over cooking on vegetablescontaining different pigments.
- 10.Demonstrate the effects of different amounts of water added to vegetablesduring cooking on flavor and appearance.
- 11.Demonstrate enzymatic browning in vegetables and fruits and any fourmethods of preventing it.
- 12.Determine the smoking point of any 4 cooking oils.
- 13. Prepare recipes using shallow fat and deep fat frying methods.
- 14.Demonstrate the stages of sugar cookery
- 15. Prepare recipes using various stages of sugar cookery and jaggery.

# ALLIED PAPER I BASICS OF BIOSTATISTICS 3 Credits

**Objectives:** This course imparts the knowledge of basic statistical methods to solve problems. Students are taught to operate various statistical software packages

**Outcomes:** The students are able to appreciate the importance of statistics in research and prepare them for a career in research

**Unit I: Introduction to Statistics:** Definition and Application Of Statistics, Qualitative Data, Quantitative Data, Frequency Distribution, Cumulative Frequency, Diagrammatical Representation Of Statistical Data(Bar, Pie), Graphical Representation Of Frequency Distribution (Histogram, Frequency Polygon, Cumulative Frequency Curves).

**Unit II: Descriptive Statistics:** Measure of Central Tendency: Mean, Median, Mode, Geometric Mean (Merits and Demerits), Measure of Dispersion: Range, Standard Deviation, Variance, (Merits and Demerits), Co-Efficient of Variation.

**Unit III. Probability:** Trial, event, sure event, random event, Sample space, Definition of probability, mutually exclusive events, Independent event, Law's of Probability - simple problems, Normal probability curve.

**Unit IV: Hypothesis Testing:** Hypothesis, Types of Hypothesis, Level Of Significance, Type I and Type II Error, Standard Error, Degrees Of Freedom, Chi Square Test, Student's t Test: One Sample t Test, Paired t Test.

**Unit V: Correlation and Regression: Correlation:** Definition, Types Of Correlation, Karl Pearson's Coefficient Of Correlation, Simple Linear Regression, One Way ANOVA.

- 1. Fundamentals of Mathematical Statistics (2015) S.C. Gupta and V. K. Kapoor
- 2. Fundamentals of Statistics (2011): S.C. Gupta
- 3. Fundamentals of Biostatistics (2014): Veer Bala Rastogi

### COMPULSORY PAPER ENVIRONMENTAL STUDIES 2 Credits

**Objective:** The main objective of this paper is to create awareness among the students about the environment

**Outcome:** The students will have a better appreciation for the environment and become responsible citizens

**Unit I:** The Multidisciplinary nature of environmental studies: Natural Resources. Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit II:** Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: Environmental Pollution: Air pollution; Water pollution; Soil pollution

- 1. Y.K. Sing: Environmental Science, New Age International Pvt, Publishers, Bangalore. 2011
- 2. Agarwal, K.C. 2011 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- 3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad. India,
- 4. Brunner R.C., 2015, Hazardous Waste Incineration, McGraw Hill Inc. 2015
- 5. Clark R.S., Marine Pollution, Clanderson Press Oxford 2015
- 6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2011, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2015
- 7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 2011
- 8. Down of Earth, Centre for Science and Environment 2011

# SEMESTER II

# PAPER I ENGLISH II

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

Unit I. Passages 1 to 4

**Unit II:** Grammar - Correct Use of Adverbs; Correct use of Prepositions; Reported Speech

Unit III: Roots (O to T); Prefixes; Suffixes

**Unit IV:** Grammar - 1. Correct Use of Conjunctions; 2. Correct use of Articles; 3. Parallelism

**Unit V:** Roots (U to Z ); New Words in English

### PART II

### ENGLISH II

**Unit I**: Passages 1 to 5

**Unit II**: Poems: "The Frog and The Nightingale" by Vikram Seth and "Ozymandias" by P.B Shelly

**Unit III:** Prose - 1. "Such Perfection" By R.K Narayan and 2. "Retrieved Reformation" by O" Henry

**Unit IV:** Poems; "Wild Swans at Coole" by W.B Yeats; "Lucy Grey" by William Wordsworth; "Stopping by Woods on a Snowy Evening" by Robert Frost

**Unit V:** Prose: "His Wedded Wife" by Rudyard Kipling and "The Merchant of Venice" (trial scene) by Shakespeare

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ಎರಡನೇ ಸೆಮಿಸ್ಟರ್
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ಪತ್ರಿಕೆ - 2 : ಸವಿಸ್ತರ - ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 2 ಭಾಗ – 1 ಸವಿಸ್ತರ ಪಠ್ಯ 1. ನಾಟಕ – 1 ಕಾಕನಕೋಟೆ – ಮಾಸ್ತಿ ವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್ ಭಾಗ – 2 ಅವಿಸ್ತರ ಪಠ್ಯ 1. ಕಾದಂಬರಿ/ವೈಚಾರಿಕ ಬರಹ ಒಡಲಾಳ – ದೇವನೂರು ಮಹಾದೇವ ಭಾಗ– 3 ಆಡಳಿತ ಕನ್ನಡ – 2 1. ಅರ್ಜಿ : ಸ್ವರೂಪ ಮತ್ತು ವಿವಿಧ ಬಗೆಗಳು ಕಡತ (ಫೈಲು)
 ಕಚೇರಿ ಕಾರ್ಯವಿಧಾನ ಮತ್ತು ಕಚೇರಿ ಟಿಪ್ಪಣಿಗಳು ಸರ್ಕಾರಿ ಪ್ರಕಟಣೆ, ಜಾಹೀರಾತು (ಸ್ವರೂಪ–ರಚನೆ) 4. ಭಾಗ– 4 ಸವಿಸ್ತರ ಪಠ್ಯ ಕಾಕನಕೋಟೆ ನಾಟಕದಲ್ಲಿನ ಪಾತ್ರಗಳು, ಘಟನೆಗಳ ಸ್ವಾರಸ್ಯ ವಿವರಣೆ ಮತ್ತು ವಿಶ್ಲೇಷಣೆ ಭಾಗ – 5 ನಾಟಕ ಮತ್ತು ಕಾದಂಬರಿಗಳ ಕುರಿತು ವಿಮರ್ಶೆ ಮತ್ತು ಚರ್ಚಾತ್ಮಕ ವಿಶ್ಲೇಷಣೆ
#### Core Paper II Applied physiology 4 Credits

**Course Objectives:** This course will highlight Cell histology and provides an understanding on functioning of cell in the life process. Further, it will also illustrates on anatomy and normal physiology of the digestive system, respiratory system, circulatory system, blood, endocrine system, Nervous system, reproductive system to understand about the function of the body, various mechanisms involved in the human system

**Course Outcomes:** Through the course, the students will learn about the functions mechanism of different parts of human body and body mechamsim in normal and pathological conditions.

**Unit I: Cells, tissues and sensory organs:** Cell as a unit of the body- Cell organelles and their functions. Tissues – types structure and function. Anatomical aspects of the body. Sensory organs- eye, ear, tongue, skin etc.

**Unit II: Digestive System, Respiratory System:** Digestive System- Major Organs of the digestive system – Mouth, tongue, Teeth. Functions of the organs of digestive system, Physiology of digestion, Absorption mechanism. Importance of Na+/Cl- ; Na+ glucose transporter, Elimination of unabsorbed food materials. Digestion and absorption of food and the role of enzymes and hormones. Respiratory System- Major organs of the body, Functions of the organs of respiratory system, Physiology of exchange of gases, Muscular exercise – tidal and vital volumes

**Unit III.** Circulatory System and Endocrine system: Circulatory System- Blood, Blood and its composition, Blood Groups, Coagulation of blood. Structure of heart- Arterial system, Venous system – afferent vessels. Blood circulation- Structure and functions of heart, Heart rate, Cardiac output. Endocrine system - general functions of endocrine glands

**Unit IV Nervous System, Reproductive System and Excretory System:** Nervous System - Nerve cell structure and function. Brain – Major division and sensory motor neurons. Central nervous system, Autonomic NS, Parasympathetic NS. Reproductive System- Structure and functions of sex glands and organs including hormones. Menstrual cycle – estrogen verses progesterone and Testosterone-single hormone impact. Excretory System - Structure and functions of Kidney, bladder, formation or urine. Counter current mechanisms in regulating blood pressure

**Unit V:** Immunology, Communicable and non - communicable diseases: Immunology. General principles, types of IgGs. General structure of IgGs, T-Cells, -Cells structure & functions. Communicable and non - communicable diseases – causative factors and preventive measures

# Practical 2: Human Physiology 4 Credits

- 1. Microscopic study of tissues- epithelial, connective and muscular.
- 2. Collection of blood sample- Capillary blood from finger tips and venous blood.
- 3. Separation of blood components (Centrifugation).
- 4. Estimation of hemoglobin- Sahli's Acid hematin method.
- 5. Determination of Hematocrit (Wintrobe method).
- 6. Preparation and examination of stained blood smear (Wedge or glass slide method).
- 7. Determination of Erythrocyte Sedimentation Rate (Wintrobe method).
- 8. Determination of blood group.
- 9. Determination of bleeding time (Duke method) and coagulation time (Capillary tube method).

#### **Reference Books:**

- 1. JlaniRL (1995). Understanding Medical Physiology. Published by Jaypee Brothers Medical (P) Ltd, New Delhi, India
- 2. Chatterjee CC (1988). Text book of Medical physiology. Published by W.B, London
- 3. Silverthorn, D. Human Physiology, (5th ed). Published by Benjamin-Cummings PubCo.

### Allied Paper II Principles of Biochemistry 3 Credits

**Objectives:** The course aims to provide exposure to the students regarding the importance of biological macromolecules and their role in reactivity of biomolecules

**Outcomes:** At the end of the course, the students have a thorough understanding on the role of biomolecules and their functions. Being an allied paper it ensures to create enough relevance with role of biomolecules in life to all disciplines like

biotechnology, microbiology, food, nutrition and dietetics; as well as environmental sciences.

**Unit I:** Introduction of Cells, Water, Thermodynamics, Bonds, Photosynthesis and Respiration.

**Unit II:** Carbohydrates-Classification, Metabolism: Glycolysis, Gluconeogenesis, Krebs Cycle, Pentose Phosphate Pathway, Glyoxylate cycle. Electron Transport Chain, ATP Synthesis.

**Unit III:** Classification of Amino Acids. Peptide bond, Peptides, Protein structure, Enzymes action and classification. Nitrogen cycle. Amino acid metabolism and degradation.

**Unit IV:** Classification of lipids, Fatty acid oxidation and synthesis, Lipid bilayer, Lipid transport. Ketone bodies.

**Unit V:** Nucleic acids: Types of DNA and RNA, Central dogma of Molecular Biology, Replication, Transcription and Translation.

#### **Reference Books:**

- 1. Nelson, D. L. & Cox, M. M. Lehninger, 2013, Principles of Biochemistry. Freeman - 6th edition,
- 2. U Satyanarayana, 2013, Biochemistry. Elsevier. 5th Edition.
- 3. Berg, J. M., Tymoczko, J. L. and Stryer, L. 2011, Biochemistry. Freeman -7th edition.
- 4. Voet, D., Voet, J. G., & Pratt, C. W. 2011. Fundamentals of Biochemistry (pp. 408-409). New York: Wiley – 4th edition.
- 5. Conn, E., &Stumpf, P. 2016. Outlines of Biochemistry. John Wiley & Sons 5th edition.
- 6. West, E. S., Todd, W. R., Mascon, H. S., & Van Bruggen, J. T. 2014. Textbook of Biochemistry. Oxford and IBH Publishing - 4th Edition
- 7. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J. 2013. *Molecular Cell Biology*, Freeman 7th edition.

#### SEMESTER III PART I ENGLISH III

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Passages 1 to 5

**Unit II**: Grammar; Active and Passive Voice and Modal Auxiliaries

**Unit III**: Vocabulary; Homonyms; Figures of Speech: Alliteration, Metaphor and Simile

**Unit IV**: Grammar: Foreign expressions and Phrasal Verbs

**Unit V**: Vocabulary - Figures Of Speech: Antithesis, Hyperbole, Euphemism, Iro

# PART II ENGLISH III

**Unit I.** Passages 1 to 5

**Unit II.** Poetry: "On His Blindness" by John Milton; "Solitary Reaper" by William Wordsworth; "The Road Not Taken" by Robert Frost

**Unit III.** Prose: "The Sniper" by Liam O' Flaherty and "A Hero" by R K Narayan

**Unit IV**: Poetry: "Where The Mind is Without Fear" by Rabindranath Tagore; "Ode To Autumn" by John Keats; "Lord Ullin's Daughter" by Thomas Campbell

**Unit V.** Prose: "The Open Window" by Saki and "The Bishop's Candlesticks" by Victor Hugo

#### ಪತ್ರಿಕೆ– 3 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ – 2

ಭಾಗ – 1

- ನಿಗಧಿತ ಭಾಗಗಳು: (ನಿಗಧಿತ ಪದ್ಯಗಳು ಮತ್ತು ಕಥಾಭಾಗ)
- 1. ಪಂಪನ ವಿಕ್ರಮಾರ್ಜುನ ವಿಜಯ: ದ್ವಾದಶಾಶ್ವಾಸಂ ಮಾನಸರೇನಿನ್ನೂಲು ವರ್ಷಮಂ ಬಲ್ಧಪರೇ
- 2. ಜನ್ನನ ಯಶೋಧರ ಚರಿತೆ ಮಾಡಿದುದಂ ನಾವುಣ್ಣದೆ ಪೋಕುಮೆ

#### ಭಾಗ – 2

- 1. ನಿಗದಿತ ಹತ್ತು ವಚನಗಳು ಬಸವಣ್ಣ । ಅಲ್ಲಮಪ್ರಭು । ಅಕ್ಕಮಹಾದೇವಿ । ಅಂಬಿಗರ ಚೌಡಯ್ಯ ಅಮುಗೆ ರಾಯಮ್ಮ
- ಗೀತೆಗಳು : ಸಂಗ್ರಾಹಕ ಸಂಪಾದಕ : ಮತ್ತಿಘಟ್ಟ ಕೃಷ್ಣಮೂರ್ತಿ ಜನಪದ ಗೀತೆ : ಮುಕ್ಷಣ್ಣ ಮಳೆಯ ಕರುಣಿಸು
- ಕುಮಾರವ್ಯಾಸನ ಕರ್ಣಾಟ ಭಾರತ ಕಥಾಮಂಜರಿ : ಅರಣ್ಯಪರ್ವ ಸೌಗಂಧಿಕದ ಪವನನ ಬಳಿವಿಡಿದು

#### ಭಾಗ – 3

ಅವಿಸ್ತರ ಪಠ್ಯ

ಸಮಾಜಸುಧಾರಕ ಮಹಾತ್ಮಪುಲೆ (ಮೂಲ ಮರಾಠಿ ಕರ್ತೃ : ಮುರಳೀಧರ ಜಗತಾಪ) ಕನ್ನಡಕ್ಕೆ ಅನುವಾದಕರು : ಅಕಿಂಚನ – ನವಕರ್ನಾಟಕ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು.

#### ಭಾಗ – 4

- 1. ಕನ್ನಡ ಪದಕೋಶದ ಬೆಳವಣಿಗೆ
- 2. ದೇಸಿ, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು ಮತ್ತು ಪಾರಿಭಾಷಿಕ ಪದಗಳು
- 3. ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಸಂಪಾದಕರಿಗೆ ಪತ್ರ
- 4. ವರದಿ

ಭಾಗ – 5

- 1. ಪ್ರಾಚೀನ ಹಾಗೂ ಮಧ್ಯಕಾಲೀನ ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಸಾಂಸ್ಕೃತಿಕ, ಸಾಮಾಜಿಕ ಮತ್ತು ರಾಜಕೀಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಪಠ್ಯದ ವಿಮರ್ಶೆ
- 2. ಜೀವನ ಚರಿತ್ರೆಯ ಸ್ವರೂಪ ಲಕ್ಷಣ ಹಾಗೂ ನಿಗಧಿತ ಪಠ್ಯದ ಅವಲೋಕನ.

#### Paper Core III Public Health Nutrition 4 Credits

**Course Objectives:** This course will illustrate on the role of nutrition education and communication on public health. It will provide knowledge on methods of assessing nutritional status of an individual as well as community health. It will illustrate on indicators in estimating mortality and morbidity status in the community and global level.

**Course Outcomes:** By the end of this course, this chapter will enlighten students in understanding the significance of nutrition towards management of individual and community health, Student will learn about the relationship of nutrition towards health and diseases. Students will understand about impact of nutritional programs towards societal, national and global developments

**Unit I: Public health nutrition education and communication:** Public health nutrition education. Definition , objectives, Principles of planning, executing and evaluating nutrition education programs, problems of nutrition education. PHN Team – Role of Public Health doctor/ Nutritionist in Health Promotion. Levels of health education- individual and family health education, group health education and education of general public - planning and evaluation of education program. Communication in public health education- key elements and barriers of communication; (auditory aids, visual aids and combined AV aids)

**Unit II. Methods of assessing nutritional status:** Assessment of nutritional status in individuals and population: Anthropometry, clinical assessment and dietary assessment methods, biomarkers - their advantages and disadvantages. Assessment methods- principle, objective methods (doubly labeled water method, and subjective methods (Physical activity).

**Unit III. Vital statistics and its Key indicators:** Concept of Demography, Growth rate. Morbidity and mortality rates: IMR, NMR, PMR, MMR. WHO growth standards - its classification, uses and implications. Key indicators used in public health- Indicators used to define a nutrition/ health problem- with reference to Prevalence of underweight, wasting, stunting for declaring nutrition emergency (Maternal and Child nutrition related indicators)

**Unit IV. Communicable, non communicable disease, Nutrition problems in relation to public health:** Communicable and non communicable disease- causes, modes of transmission and preventive measures (general only). Public health aspects of over and under nutrition: BMI criteria by WHO; Over nutrition - Obesity as a determinant of mortality and morbidity; under nutrition- definitions, clinical syndromes and public health consequences of under nutrition. Nutrition related problems in India, consequences & vulnerable age groups

**Unit V: Nutrition policies, national and international programs:** Nutrition related policies and programs: Health, nutrition and family welfare. National Food Security Act; National Food for Work Program. Nutrition/ Health system & gov-ernance system in India with special focus on Karnataka (center, state, districts, blocks. ICDS- objectives and services; Public Distribution System; Anthyodaya Anna Yojana; National and international agencies in combating malnutrition- International- WHO, FAO, UNICEF- Aim and functions. National- ICAR, ICMR, NIN, NFI, FNB, CFTRI, NNMB, NSI, DFRL- Aim and functions.

# **Reference Books:**

- 1. Michael J. Gibney, Barrie M. Margetts, John M. Kearney and Lenore Arab, Public health nutrition, Blackwell publishing company. 2015.
- 2. Mark Lawrence and Tony Worsley, Public health nutrition from principles topractice, Chennai microprint (P) Ltd., Chennai. 2017.
- 3. Srilakshmi. B, Nutrition science, fifth edition, New age international (P) limited. 2016.
- 4. Park.K, Text book of preventive and social medicine, BanarsidasBhanotpublishers, Jabalpur. 2017.
- 5. K. Park (2011). Text Book of Preventive and Social Medicine, 21st Edition.
- 6. Lal S. (2010) Textbook of Community Medicine , CBS PublicationTracking progress on child and maternal Nutrition UNICEF (2009)
- 7. International Institute for Population Sciences (IIPS) and Macro International. 2007.
- 8. National Family Health Survey (NFHS-3), 2005-06: India: Volume I. Mumbai: IIPS.

#### Core Paper IV Principles of Human Nutrition 4 Credits

**Course Objectives: The course will highlight on the** nutritional requirements needed to understand the appropriate portion size of food intake by the normal individual. It will provide knowledge on assessment of energy requirements promotes understanding of evaluating the energy needs for the humans. It will also focus on the interrelationship between nutrition during development process.

**Course Outcomes: Through this course, s**tudents will understand about the evaluating the normal nutrient requirement for an individual. Students will learn about the physiological functions of various nutrients in the body. Students will understand consequences of nutritional deficiency and toxicity on health

**Unit I. Principles of Dietary Guidelines:** Concept of Nutrition- Definition of nutrition, health, nutritional status and malnutrition. RDA- Definition, factors affecting RDA and methods used for deriving RDA. Dietary Guidelines using Reference Man and Reference Woman.

**Unit II. Energy requirement in Human:** Definition of Energy, units of measurement, Energy Balance, Assessment Of Energy Requirements - direct and indirect calorimetry; Determination of Energy in food, B.M.R. and its regulation, -S.D.A, Total Energy requirement, Factors affecting physical activity, Basal Metabolic Rate, Thermic effect of food,

**Unit III. Carbohydrates, Proteins and Lipids: Carbohydrates-** Definition, composition, functions, maintenance of blood sugar levels, requirement, sources, digestion and absorption; Dietary fiber- Definition, classification, physiological effects and sources. **Proteins**- Definition, composition, nutritional classification of proteins and amino acids, functions, sources, requirements, digestion and absorption. Evaluation of protein quality: PER, BV, NPU and Chemical score. **Lipids**- Definition, composition, functions, sources, requirements, digestion and absorption. Essential fatty acids – Definition, functions, sources and effects of deficiency.

**Unit IV. Macro Mineral and Micro minerals: Macro Mineral:** Calcium and Phosphorous - classification, physiological effects and sources requirements and effects of deficiency. **Micro minerals :** Iron, Iodine, Copper, Fluorine and Zinc, So-dium and Potassium - Functions, sources, requirements and effects of deficiency

**Unit V. Fat soluble Vitamins and Water Soluble Vitamins: Fat soluble Vitamins:** Vitamin A, D, E and K. Classification, physiological effects and sources requirements and effects of deficiency. Water Soluble Vitamins: Thiamine, riboflavin, niacin, ascorbicacid, folic acid, vitamin B6 and vitamin B12 - Functions, requirements, sources and effects of deficiency.

# **Reference Books:**

- 1. Sumathi R. Mudambi, Rajagopal, M.V., Fundamentals of Foods and Nutrition, NewAge International (P) Ltd, Publishers, Third edition, 2011.
- 2. SrilakshmiB., Nutrition Science, New Age International (P) Ltd, Publishers, Fifthmulti color edition, 2016.
- 3. MangalaKango, Normal Nutrition, Curing diseases through diet, CBS Publications, First edition, 2015.
- 4. Paul.S., Text Book of Bio-Nutrition, Fundamental and Management, RBSA Publishers, 2013.
- 5. Sue Rodwell Williams, Nutrition and Diet Therapy, C.V. Melskey Co., 6 th edition, 2013.
- 6. Mahtab. S.Bamji, Kamala Krishnaswamy and G.N.V Brahmam, Text Book ofHuman Nutrition, Oxford and IBH Publishing Company, Third Edition.2011.

#### Core Practical III Assessment of Nutritional status 4 Credits

- 1. Anthropometric Measurement Height, weight, skinfold thickness, mid upper arm circumference.
- 2. Comparison and interpretation of the nutritional assessment data and its significance body Mass Index (BMI), fat mass, Waist Hip Ratio (WHR).
- 3. Estimation of food and nutrient intake 24 hours dietary recall, food frequency.
- Planning, calculation and preparation of diets for different age groups (a) Infant, with reference to weaning foods. (b) Children (c) Adolescents boys and girls (d) Adults—Men and women engaged in sedentary, moderate and heavy work. (e) Pregnant and lactating women.
- Clinical assessment and signs of nutrient deficiencies especially PEM (Kwashiorkor, marasmus) vitamin A deficiencies, Anaemia, Rickets, B-Complex deficiencies.
- 6. Methods of Extension education used in community- a) Preparation of visual aids-charts, posters models, etc. for exhibition. b) Lecture and Method Demonstrations to target groups.
- 7. Diet and nutrition survey- Identifying vulnerable and at risk groups
- 8. Hospital visits to observe nutritional deficiencies

#### ALLIED PAPER III FUNDAMENTALS OF BIOINFORMATICS 2 Credits

**Objectives:** This allied paper introduces the students to concepts in bioinformatics

**Outcomes:** The student will be able to apply basic principles of biology, computer science and mathematics to address complex biological problems

**Unit I:** Introduction and history of bioinformatics–Internet, World Wide Web, Web browser, EMBnet, NCBI. File transfer protocol.

**Unit II:** Database browsers and search engines. Introduction to MS access, making queries, Designing forms, Report design

**Unit III:** Database-Definition, DBMS, Biological Databases– FASTA, Blast, Genbank, DNA sequence data bases, Protein databases.

**Unit IV:** Entry formats, carbohydrate databases, Enzyme databases, Pathway databases. Relational data base model. Theory on RDBMS. SQL.

**Unit V:** Application aspects– gene prediction, target searching's–drug designing – E-cell, phylogenetic analysis, PERL, Chemo-informatics.

#### Reference Books:

- 1. Introduction to Bioinformatics. T.K.Altwood, D.J.Parry-Smith (2014) Pearson Education.
- 2. Bioinformatics for the beginners by K. Mani & N. Vijayaraj (2015). Jaypee Publishers.
- 3. Proteomics- Pennigton & Dunn (2012). Viva books publishers, New Delhi
- 4. Bioinformatics-A practical guide to the analysis of genes & protein. 2nd Edition. Andreas, Baxevanis and Francis Ouellette.

#### SKILL BASED PAPER I BASICS OF COMPUTERS 4 Credits

**Objectives:** This is a skill-based paper that introduces the students to the basics of computer operations. The student is imparted with knowledge on both hardware and software.

**Outcomes:** The student has a better understanding on the use of computers for various applications

**Unit-I:** Fundamentals of Computer, MS- Office, and Operating System

**Unit-II:** Basics of HTML, HTML 5, J- Query, Database Management System

**Unit-III:** Basic Networking, VB- Visual Basics, Data Structure using C++

**Unit-IV:** Software Engineering, Asp.net, Computer Graphics.

# **Unit-V:** Training on SPSS Software

#### **Reference Books:**

1. Rajib Mall, Fundamentals of Software Engineering (2015), Prentice Hall of India

# **SEMESTER IV**

# PART I ENGLISH IV

**Objectives:** These courses are designed to develop the communication and vocabulary skills in the students

**Outcomes:** Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

**Unit I**: Comprehension Passages and Poems

Unit II: Grammar: Formal Letter Writing and Report Writing

Unit III. Grammar: Story writing. Subject Verb Agreement. Essay writing

**Unit IV**: Vocabulary: Onomatopoeia and Personification

**Unit V**: Vocabulary: Pun, Role Plays and Headline English

#### PART II ENGLISH IV

**Unit I**. Poetry: "Mending Wall" by Robert Frost" and "I Know Why a Caged Bird Sings" by Maya Angelou

**Unit II.** Poetry: "Ode to the West Wind" By P. B Shelly, "The Brook" by Alfred Tennyson and "This is going to hurt "by Ogden Nash

Unit: III. Prose - "An Astrologers Day" By R K Narayan and Mahatma Gandhi

**Unit IV**: Prose: "The Refund" by Fritz Karinthy

**Unit V: Prose:** "The Last Leaf" by O 'Henry

#### ಪತ್ರಿಕೆ – 4 ಸವಿಸ್ತರ – ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ

ಭಾಗ – 1

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ – 1 : ( 6 ಸುನೀತಗಳು)		
1. ಕವಿತಾವತಾರ	:	ಎಂ. ಗೋವಿಂದಪೈ
2. ಜೀವ ರೇಶಿಮೆಯ ಹುಳು	:	ಮಾಸ್ತಿ ವೆಂಕಟೇಶ <sup>್</sup> ಅಯ್ಯಂಗಾರ್
3. ಅಲ್ಲಮಪ್ರಭು	:	ದ.ರಾ.ಬೇಂದ್ರೆ
4. ವರ್ಡ್ಸ್ವರ್ತ್	:	ಕುವೆಂಪು
5. ಕವಿ	:	ಪು.ತಿ.ನ
6. ಕಾಲ್ಚೆಂಡೆ	:	ಈಶ್ವರ ಸಣಕಲ್ಲ

ಭಾಗ – 2

ನಿಗಧಿತ ಕಾವ್ಯಭಾಗ - 2 : ( 6 ಸುನೀತಗಳು)

1.	ಸಣ್ಣಸಂಗತಿ	:	ಕೆ.ಎಸ್.ನ
2.	ತವರ ಮನೆಯಿಂದ ನಾ ನಿನ್ನ ಕರೆಸಿದನೇಕೆ	:	ವಿ.ಜಿ.ಭಟ್ಟ
3.	ಸ್ಥಾವರಕ್ಕಳಿವುಂಟು	:	ಜಿ.ಎಸ್.ಎಸ್
4.	అంతర	:	ಚೆನ್ನವೀರ ಕಣವಿ
5.	ಅನುಭವ ಮಂಟಪ	:	ಜಿ.ಎಸ್.ಸಿದ್ದಲಿಂಗಯ್ಯ
6.	ದೈವ ಕಲಿಸುವ ಪಾಠ	:	ಕೆ.ಎಸ್.ನಿಸಾರ್ ಅಹಮದ್

ಭಾಗ -	- 3		
ಅವಿಸ್ತರ	ರ ಪಠ್ಯ– ಗದ್ಯಭಾಗ : ಕಥೆಗಳು		
1.	ಶುಕ್ರಚಾರ್ಯ	:	ಬಾಗಲೋಡಿ ದೇವರಾಯ
2.	ನಲ್ಲಿಯಲ್ಲಿ ನೀರು ಬಂತು	:	ಕೆ.ಸದಾಶಿವ
3.	ನಿರಾಕರಣೆ	:	ವೀಣಾ ಶಾಂತೇಶ್ವರ
4.	ಬುರ್ಖಾ	:	ಫಕೀರ್ ಮಹಮ್ಮದ್ ಕಟ್ಟಾಡಿ
5.	ಅಲ್ಲಿ ಆ ಅಳು ಈಗಲೂ	:	ಮೊಗಳ್ಳಿ ಗಣೇಶ್

#### ಭಾಗ – 4 ಆಡಳಿತ ಕನ್ನಡ

- 1. ಗಾದೆಯ ಸ್ವರೂಪ, ಬಳಕೆ ಮತ್ತು ವಿಸ್ತರಣೆ
- 2. ವಾಕ್ಯ ರಚನೆ : ಸರಳ ವಾಕ್ಯಗಳು, ಸಂಕೀರ್ಣ ವಾಕ್ಯಗಳು
- 3. ಪ್ರಬಂಧದ ಸಾಮಾನ್ಯ ಸ್ವರೂಪ, ರಚನೆ
- 4. ಸಂಕ್ಷೇಪನ ಲೇಖನ ಸ್ವರೂಪ, ಪ್ರಾಯೋಗಿಕ ರಚನೆ

#### ಭಾಗ – 5

- 1. ನವೋದಯ ಸಾಹಿತ್ಯದ ಕಾಲಘಟ್ಟದಲ್ಲಿ ಸುನೀತ ಪ್ರಕಾರದ ಹುಟ್ಟು ಬೆಳವಣಿಗೆ.
- 2. ಸುನೀತದ ಲಕ್ಷಣ, ಸ್ವರೂಪಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಾವ್ಯಭಾಗದ ವಿವೇಚನೆ
- 3. ಧಾರ್ಮಿಕ, ರಾಜಕೀಯ ಹಾಗೂ ಸಾಮಾಜಿಕತೆಯ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ನಿಗಧಿತ ಕಥಾಭಾಗದ ವಿಮರ್ಶೆ

#### Core Paper V Dietetics 4 Credits

**Course Objectives:** This chapter promotes the understanding towards planning a diet for normal and diseases cases. It will enhances knowledge on dietary planning as an important tool for screening and managing disease. Understands about role of Dietary management in infections, fevers and allergy and deficiency. Understands about the role of Dietary management in obesity, underweight, lung disease, gastrointestinal tract disease, liver and gall bladder disease. Understands about the role of Dietary management in CVD, Diabetes mellitus, kidney and urinary tract disease

**Course Outcomes:** Student will learn about the dietary management in normal health and various diseases condition. Enlightens student knowledge on dietary planning and assessment as an important tool for screening and managing disease

**Unit I. Dietary therapy and Nutrition counseling:** Diet therapy – Concept, purpose and principles of diet therapy, modification of normal diet, types of diets. Dietitian – Classification, code of ethics, responsibilities. Nutrition counseling - Definition, goals, scope and limitations. Practical consideration in giving dietary advice and counselling. Communication of dietary advice, Consideration of behaviour modification, motivation towards individual food choice. Counseling Process – Counseling the client/patient – client concurrence, coordination of care plans-the provision of learning experience.

**Unit II. Dietary diagnosis and Implementation**: Dietary diagnosis- Techniques for obtaining relevant information. Clinical Information, General Profile and Medical History, nutritional assessment, Assessing food and nutrient intakes, Lifestyles, physical activity, stress. Special feeding methods – Enteral nutrition, tube feeding, parenteral feeding nutrition and total parenteral feeding nutrition. Implementation - computers applications for dietary computations by the dietitian, dietetic management through education/ training. Teaching aids used by dietitians - charts, leaflets, posters etc., preparation of teaching material for patients suffering from Digestive disorders, Hypertension, Diabetes and Atherosclerosis .

**Unit III. Dietary management in obesity, underweight, lung disease, gastrointestinal tract diseases, liver and gall bladder disease.** Diet in Obesity and underweight -Definition, causes, types, treatment and dietary management. Diet in lung diseases - Asthma, chronic bronchitis and emphysema – Causes, symptoms and dietary management. Diet in gastrointestinal tract diseases - Constipation, diarrhoea, ulcers and inflammatory bowel diseases – Types, causes, symptoms and dietary management. Diseases of the liver and gall bladder: a) jaundice b) hepatitis

**Unit IV. Dietary management in cardiac problems and Diabetes, Kidney disease: Diseases of the cardio vascular system** (risk factors and diet therapy). a) atherosclerosis b) arteriosclerosis c) hypertension d) congestive heart failure. Diabetes mellitus – causes, symptoms, bio-chemical changes, insulin, hypo- glycemic drugs, food exchange list, dietary management. **Diseases of the kidney and urinary tract -** Causes and dietary treatment of kidney diseases and dialysis. a. Acute and chronic nephritis, b. Nephrotic syndrome, c. Renal failure, d. Urinary calculi and e. Uremia.

**Unit V. Dietary management** in infections, fevers, allergy: Surgical diets: Pre operative and post operative diets. Diet in infections and fevers – Typhoid, influenza, tuberculosis, chikungunea, Malaria and AIDS –Definition, causes, symptoms, and dietary management.

Diet in Allergy - Definition, classification, common food allergy, test of allergy, diet therapy. Diet in relation to deficiency diseases-Protein calorie deficiency, vitamin A deficiency and anemia.

# **Reference Books:**

- 1. Antia F.P. Clinical dietetics and nutrition. Oxford University Press, NewDelhi 2008.
- 2. Mahan, L.K. and Escott-Stump S., Krause's Food Nutrition and Diet Therapy10th Edition, W.B. Saunders Ltd, 2000.
- 3. Zeeman, Frances J. Applications of clinical nutrition. Englewood cliffs: Prentice Hall International Inc., 1998.
- 4. Robinson. Normal and therapeutic nutrition.: Macmillan Pub. Company NewYork , 2006.
- 5. Sumati R. Mudambi, M.V. Rajagopal., Fundamental of food, nutrition and diettherapy. New age international publishers, New Delhi, 2015.
- Srilakshmi B., Dietetics, New age international publishers, New Delhi1. Krause and Mahan – Food ,Nutrition and Diet therapy, 6th Edition W.B. Saunders company,
- 7. ICMR(2010) : Nutrient Requirements and recommended dietary allowances for Indians.
- 8. Shubhangini. A. Joshi (2002) Nutrition and dietetics, Tata McGraw- Hill publishingCompanylimited, New Delhi.
- 9. Carolynn E.Town send and Ruth A. Roth (2002) Nutrition and Diet Therapy, Delmarpublisher
- 10.The Indian journal of nutrition and dietetics, Avinashilingam Deemed University, Coimbatore

# Practical 4: Dietetics 4 Credits

- 1. Grouping of foods according to ICMR classification.
- 2. Find the percentage of edible portion of foods.
- 3. Standardization of common food preparations.
- 4. Planning, preparation and calculation of following diets :
  - Normal diet.
    - Liquid diet
    - Soft diet
    - High and low caloric diet
    - High Protein diets.
    - High protein diets.
    - Bland diet
    - Diet for Diabetes mellitus
  - Diet for Hypertension and Atherosclerosis
- 5. Low and medium cost diets for PEM, Anemia & vitamin A deficiency.
- 6. Food Exchange System and Standardization of Raw to Cooked Foods
- 7. Planning, preparation and nutritional evaluation of diets in relation to activity levels and
- 8. physiological state.

9. Planning and preparation of a balanced diet for a pregnant woman, lactating woman, pre-school child, school going child, adolescence, senior citizen.

# ALLIED PAPER IV FUNDAMENTAL OF NANOTECHNOLOGY 3 Credits

**Objectives**: This is an interdisciplinary and emerging area. The students are taught the basics of nanotechnology and their applications

**Outcomes**: The course introduces the students to the new and novel applications to solve biomedical problems through nanotechnology

**Unit I: Introduction to Nanotechnology:** Fundamentals of Nanoscience, History of Nanoscience and Nanotechnology, Properties of nanomaterials - optical, electronic and magnetic properties.

**Unit II: Classes of Nanomaterials:** Metal and Semiconductor Nanomaterials, Quantum Dots, Carbon Nanotubes and Bucky balls. Organic based nanomaterials – liposomes, dendrimers, and micelles. Inorganic based nanomaterials – gold/ silver nanoparticles and magnetic nanoparticles

**Unit III:** Synthesis Nanomaterials: Top down method of synthesis - Nanolithography, CVD, ball milling. Bottom-up method of synthesis – Colloidal synthesis, solgel method, Self-assembly methods.

**Unit IV: Physicochemical characterization on Nanomaterials:** Optical method (UV - Vis absorption and fluorescence spectroscopy), electron microscopy techniques (SEM and TEM).

**Unit V: Applications of Nanotechnology:** *Environmental applications* – Green nanotechnology- green synthesis of nanoparticles, Nanomaterials as solution to environmental problems. Pesticide removal in ground water using nanoparticles. *Industrial applications of nanotechnology; Cosmetic Industry* – nanoparticles based sunscreens, antimicrobial creams. *Food Industry* – Antimicrobial coatings and smart packaging. Nanomaterial based food supplements. *Textile Industry* – Stain resistant textiles, self-cleaning and flame resistant textiles. *Agriculture sector* – Crop improvement, Nano-fertilizers. *Nanomedicine* – Cancer Nanotherapy and Point of care diagnostics

# **Reference Books:**

- 1. A.Nabok, "Organic and Inorganic Nanostructures", Artech House, 2011
- 2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2017
- 3. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2012.

#### ALLIED PRACTICAL-III & IV BIOINFORMATICS & NANOTECHNOLOGY 2 Credits

- 1. To calculate the absorption coefficient from UV-Vis spectrometer.
- 2. To do the peak analysis of IR transmission spectrum using FTIR spectrometer
- 3. Trace out the emission spectra for UV excited luminescent sample
- 4. To determine particle size of nanoparticles using UV spectra
- 5. To synthesis nanoparticles using colloidal method

#### **Bioinformatics Lab:**

- 1. Basics of primary data base
- 2. Use of Blast
- 3. Sequence analysis
- 4. Protein translating using Expasy
- 5. Building protein using PDB
- 6. Phylogenetics tree analysis using MEGAIO software
- 7. KEGG pathways
- 8. ORF Finder
- 9. NEB cutter
- 10.Use of prime 3 software

#### SKILL BASED PAPER II Tissue Culture 4 Credits

**Objectives:** This skill based course introduces the students to the concepts in tissue culture applicable to plants and animals

**Outcomes:** They are also taught their applications in biotechnology and biochemical research. This course introduces the students to explore entrepreneurial avenues in this field

**Unit I:** Types of Plant Cultures: Introduction to organogenesis, Production of haploid plants and their applications, Ovary and ovule culture, In vitro pollination and fertilization, Pollen culture, Anther culture, Embryo culture: History and methodology, Embryo rescue after wide hybridization, Applications, Somatic embryogenesis, Endosperm culture and production of triploids, Single cell suspension cultures and bioreactors, Protoplast isolation and culture, Meristem, axillary and shoot tip culture: micro propagation

**Unit II:** Applications of Plant Tissue Culture, Soma clonal variation and applications, Somatic Hybridization and its applications, Virus free plants, Germplasm conservation, Synthetic seeds, DNA transformation methods in plants and applications, Hairy root culture, Secondary metabolite production

**Unit III:** Types of Animal cell culture, Organ culture, Primary explant cultures, and Established cell lines, commonly used cell lines: origin and characteristics, Growth kinetics and cells in culture, Bioreactors for large scale culture of cells, Cell fusion, Transplantation of cultured cells (Grafting)

**Unit IV:** Applications of animal cell culture, Limitations and ethical issues, Transfection and transgenic animals, Expressing cloned products in animal cells, The need to express in animal cells, Over production and processing of chosen protein, Production of special secondary metabolites/ products (insulin, growth hormone, interferon, t – plasminogen activator, factor VIII etc), Production of vaccines using animal cell culture, Production of monoclonal antibodies and its applications, In

vitro fertilization

**Unit V:** Study of laboratory equipment's, Stocks and Media preparation, Sterilization techniques in plant tissue culture, Explant selection, treatment and inoculation, Subculture of initiated cultures, Acclimatization of cultures, Extraction of proteins from plants and its estimation, Extraction of DNA/RNA from plants and its estimation, Estimation of peroxidase activity in plants, Study of  $\beta$  – amylase enzyme from germinated pulses, Demonstration of animal cell culture technique.

## **Reference Books:**

 Plant Tissue Culture, Theory and Practice, Rev Ed – S. S. Bhojwani, M.K. Razdan. (2015). Animal Cell Culture and Technology– M Butler. (2014). Freshney's Culture of Animal Cells. (2011).

## SEMISTER V Core Paper VI Food Preservation and Adultration 4 Credits

**Course Objectives:** This course chapter promotes students in understanding about the Principles of food preservation. Understands about the Different Methods of Food preservation. Understands about the role of food preservation techniques in food storage and maintaining food safety. Understands about the food adulteration, Food safety and food laws in maintaining food quality .Understands about the consequences of food adulteration on foods

**Course Outcomes:** Students attain understanding the food preservation techniques in keeping food safe. Students will learn about the Food safety and food laws aspects in maintaining food quality. Students will enlightens towards understanding the consequences of food adulteration

**Unit I. Basic Concepts in Food Preservation:** Food preservation - Definition, Factors effecting the preservation of a food product. General Principles and importance of food preservation, Factors affecting growth of microorganisms. Storage of perishables and semi – perishable foods

**Unit II. Preservation using various technologies:** low temperature- freezing and deep freezing

high temperatures-drying, pasteurization, dehydration, smoking and curing, irradiation- UV and gamma radiations, Spray drying, Lyophilization, Vacuum packaging, Canning, fermentation-vinegar, alcoholic beverages

**Unit III. Methods of Food Preservation:** Preservation by addition of external ingredient: brining, sugaring, pickling, carbonation and syruping, chemical preservatives. Preparation of preserved Food Products: Fruit juices, squashes and cordials Jams, jellies and marmalades, Chutneys and sauces. Ready to eat foods and Ready to reconstitute foods

**Unit IV. Food Adulteration:** Food Adulteration: definition, Methods of food adulteration, Intentional and unintentional food adulteration. Effect of food adulteration on food quality & nutritive value of foods. Food Laws and PFA strandards.

Unit V. Food Adulterants: Common food adulterants, Food Additives as adulter-

ants, Health hazards of food adulterants, Tests for detecting food adulterants in food products- domestic and industrial

## Core Paper VII. Principles of Meal Planning 4 Credits

**Course Objectives:** The course highlightes and explains about adequate nutritional requirements for an individual. Understands about the diet planning principles to evolve the nutritional requirements of individual. Understands about the nutritional requirements during pregnancy, lactation and infancy. Understands about the nutritional requirements during preschool children, school children, adolescence, adults and old age

**Course outcomes: By the conclusion of this** chapter students will understand about the balance diet and adequate nutritional requirements for different age groups, develop dietary planning and guidelines for the nutritional requirements by an individual, and will learn about the nutritional values of weaning foods and traditional foods needed during infancy. This is essential to build their career in health care institutions.

**Unit I. Dietary guidelines for Indians:** Current diet and nutrition scenario. Dietary guidelines for Indians, Food Pyramid and Balanced diet

**Unit II. Estimation of Nutrient requirements:** RDA for Indians, basis for requirement, Reference body weight. The ten food groups – importance, nutrients provided by each group, sources and functions. Nutrient requirements-, Energy requirements and basis of setting energy requirements , energy allowance for various activities. Basis of setting requirements for Protein, Fat, Dietary fiber, Minerals, Vitamins.

**Unit III. Importance of Meal Planning:** Basic meal pattern and its need to suit different income levels age and physiological stages. Exchanges of foods and amounts – Use of weights and measures. Importance of meal planning and factors affecting meal planning

# Unit IV: Nutritional requirement and Meal planning in pregnancy, lactation, infancy,

**weaning foods: Pregnancy** - Normal growth and weight change, complications during various stages of pregnancy. **Lactation** – Milk output and factors affecting it, nutritional components of colostrum and mature milk. **Infancy** - factors influencing growth and development, difference between breast feeding and bottle feeding. Different types of milk formulae. **Weaning Foods** - Weaning foods, traditional and commercial formulae.

# Unit V. Nutritional requirement and Meal planning in preschool and school children,

adolescence, adults, elderly: pre-school and school children– Nutritional problems – eating disorders, dental caries and packed lunch. Adolescence – Physical changes, growth Increments during menarche, Nutritional problems - IDA, obesity, anorexia nervosa and bulimia nervosa. Adults (men and women) – Menopausal and post menopausal women, nutritional. Elderly - Physiological changes in ageing, Nutritional problems of aged and their management.

# **Reference Books:**

- 1. Shubhangini. A. Joshi (2002) Nutrition and dietetics, Tata McGraw- Hill publishingCompanylimited, New Delhi.
- 2. Carolynn E.Town send and Ruth A. Roth (2002) Nutrition and Diet Therapy, Delmarpublisher

#### Core Paper VIII Food service management 4 Credits

**Course Objectives:** The course will help students understand about the types of catering institutions and food services, food services and its management, principles and organizational structure for catering in food service management. About the menu planning, kinds of menus in the food service institution and about the storage methods and food production in food service management

**Course Outcomes:** By end of the course, **s**tudents will be able to explain functioning of food service management, on menu designing, organization chart, food production in the food service institution and technical skills for the students to create a career in the food service institution

**Unit I. Catering institutions and services:** Different types of catering institutions and services, classifications of food service institutions according to; Function: Profit oriented, service oriented and public health facility oriented. Method of processing: Conventional systems, Commissary system, fast food service system.

**Unit II. Arts in food service:** Arts in food service - Design selection-structural and decorative. Elements of design, principles of design, and their application in food service institutions. Color - Qualities of color, color schemes, flower arrangement-application of art principles in arranging flowers, styles and types. Table service - Application of art in table service. Management - Definition, principles and techniques of effective management, leadership and managerial abilities. Tools of management-organizational chart, work study and work improvement.

**Unit III. Personnel management, financial management, sanitation and safety:** Organisation - Types and principles, organizational structure for catering institutions. Personnel Management - Methods of selection, orientation, training, supervision and motivation of employees, importance of good human relations, legal aspects of catering. Cost control - Principles and methods of food cost control. Financial management –Factors affecting food, labour, operating and overhead cost, budget, inventories. Sanitation and safety- significance of hygienic management in food preparation and service, sterilization, pest control, garbage disposal. Health care of food service personnel, safety measures to be adopted in foodservice.

**Unit IV. Menu planning, Delivery and Service of Foods in food service institutions: Menu Planning -** Factors affecting menu planning, kinds of menus, wording of menu and construction of menu card. Delivery and Service of Foods: Food service systems: conventional, centralized and decentralized service. Types of service: self-service, tray service, waiter-waitress service, portable meals. Food service in commercial restaurants, hotel food service, hospital food service, industrial food service, school food service. Clearing and winding up after service. Customer relations. **Unit V.** Food Purchase, Selection, Storage procedure, food production in the food service institute: Food Purchase, Selection and Storage: Food purchasing procedure, purchasing methods and selection of foods, Storage – dry and refrigerated. Quantity Food Production:

Construction and selection of recipes for quantity cooking. Standardization of recipes.Storage and use of leftover foods.Quality control of food production, hygiene and safety procedures. Calculation of food costs, portion control, loss and profit made

# **Reference Books:**

- 1. Kulshrestha SK (2011) Food preservation, New Delhi, Vikas Publishing House Pvt Ltd.
- 2. Siddhapa GB and Tandon BL (2014) Preservation of fruits and vegetables, New Delhi, ICAR
- 3. Kukade S and Bhave N and Mehta A. (2015) Food preservation Manual, Pune, Dept of food and Nutrition, SNDT College of Home Science.
- 4. Sri Lakshmi B (2015) Food Science, 3rd Edition, New age International, New Delh
- 5. Shirley J. Vangarde and Margy Wood Burn, (2015) Food Preservation and Safety, SurabhiPublications, Jaipur.
- 6. D.K.Salunkhe,S.S.kadam-Handbook of vegetable science and technology,-Marcel Dekker Inc,New York, 2015.

#### **Core Practical V. Food Preservation and Adultration** 4 Credits

- 1. Different methods of Food preservation Drying, Freezing, Frying, canning, bottling etc.
- 2. Aseptic handling: Sources of contamination of foods.
- 3. Preparation of pickles, tomato sauce, chili sauce, jelli, tomato puree squash etc.
- 4. Detection of Vanaspati in Ghee/Butter.
- 5. Detection of Khesari flour in besan.
- 6. Detection of Metanil yellow in turmeric/colourd sweet products.
- 7. Detection of Argemon oil in edible oil
- 8. Detection of artificially colour / foreign matter in tea (dust/leaves).
- 9. Detection of adulterants in milk
- 10.Visit to canning industry and dairy firm etc

### Elective I SANITATION AND HYGIENE 4 Credits

**Course Objective:** To understands about the methods of preventing microbial growth. Understands about the methods of contamination in food products and preventive measures in contamination. Understands about the cleaning compounds as preventive measures in contamination. Understands about the cleaning steps in food service and food industry as a preventive measures for food safety. Understands about the waste disposal management as preventive measures for

food safety

**Course Outcomes:** Promotes the understanding about the contamination in food products and its preventive measures. Enlightens knowledge on the waste disposal management in food service and food industry as preventive measures for food safety

**Uni I. Sanitation, methods of inhibiting microbial growth: Sanitation**: Definition and meaning, deteriorative effects of micro-organisms physical and chemical changes. Methods of killing micro organism- heat, chemicals and radiation. Methods of inhibiting microbial growth- refrigeration, chemicals, dehydration and fermentation.

**Unit II. Contamination of food products:** Contamination of red meat, poultry and seafood during processing, contamination of dairy products and other food; other sources of contamination- equipment, employees, air and water, sewage, insects and rodents. Protection against environmental contamination, protection during storage and protection against contamination from litter and garbage, Protection against toxic substances

**Unit III.** Cleaning compounds, sanitizers: Cleaning compounds: Characteristics of good cleaning compounds. Classification of Cleaning compounds-alkaline cleaning compound and acid cleaning compound, synthetic detergents, soaps, solvent cleaners; Detergent auxiliaries- protection and cleaning auxiliaries; Souring compounds; selection of effective cleaning compound. Sanitizers: Types: thermal sanitizing, radiation sanitizing and chemical sanitizing.

Unit IV. Sanitation practices and procedures in dairy, meat, vegetable and fruit processing industry: Cleaning steps in dairy industry. Sanitation practices and procedures in meat processing industry, Cleaning steps in sea food plants, Cleaning procedure for vegetable and fruit processing industry, Cleaning steps of a food service facility.

**Unit V. Food Waste Disposal:** Waste disposal: Solid waste disposal. Waste water handling. Pre-treatment, primary treatment, secondary treatment, tertiary treatment and disinfection. Personal hygiene: Definition, need, personal hygiene. Contamination of food products; requirements for hygienic practices; sanitary handling of food.

# **Reference Books:**

- 1. Norman G. Marriott, Principles of sanitation, Van Nostrand Reinhold company, Newyork. 2015.
- 2. Mario Stanga, Sanitation: Cleaning and Disinfection in the Food Industry, Wiley, 2010.
- 3. Y. H. Hui, L. Bernard Bruinsma, J. Richard Gorham, Wai-Kit Nip, Phillip S.Tong, Phil Ventresca, Food plant sanitation, CRC Press, 2012.
- 4. Y. H. Hui, Plant sanitation for food processing and food service, CRC Press, 2014.

#### Core Practical V Food Preservation and Adulteration 4 Credits

- 1. Different methods of Food preservation Drying, Freezing, Frying, canning, bottling etc.
- 2. Aseptic handling : Sources of contamination of foods.
- 3. Preparation of pickles, tomato sauce, chili sauce, jelli, tomato puree squash etc.
- 4. Detection of Vanaspati in Ghee/Butter.
- 5. Detection of Khesari flour in besan.
- 6. Detection of Metanil yellow in turmeric/colourd sweet products.
- 7. Detection of Argemon oil in edible oil
- 8. Detection of artificially colour / foreign matter in tea (dust/leaves).
- 9. Detection of adulterants in milk
- 10.Visit to canning industry and dairy firm etc

#### Elective I NUTRITION IN SPORTS AND FITNESS 4 Credits

**Course Objectives: To gain knowledge** about the role of nutrition in physical fitness and nutritional screening in sports persons and energy needs for sports people of all age groups. The course also provides knowledge about nutritional requirements and fluid needs in sports persons and after exercise.

**Course Outcomes:** Enlightens knowledge on nutrition support during physical fitness and gain knowledge on nutritional screening and nutrients requirements for sport persons of various age groups

**Unit I. Effects of Physical fitness:** Physical fitness: Definition; benefits of physical activity

Physiology of exercise: body physiology to exercise, Muscle contraction; adaptation of muscle. Effect of physical exercise on cardio vascular and pulmonary system.

**Unit II. Aerobic & Anaerobic metabolism during exercises:** Energy sources for muscle use- ATP, phosphocreatine, glucose, fat and protein. Anaerobic metabolism during power exercises

Aerobic metabolism during endurance exercises.

**Unit III : Nutritional requirement in athletes: Athletes**: weight and body composition of athletes. Nutritional assessment and counseling for athletes. **Nutritional requirement**: Effect of differential intakes of macro nutrients (CHO, protein and fat) on the athletic endeavor

Nutrition needs of male, female, younger and older athletes.

**Unit IV: Nutritional needs during power, speed and endurance exercise:** Nutritional needs and plans during power and speed exercise. Nutritional needs and plans during endurance exercise- before, during and after. Nutrition plan during combined power and endurance sports. **Unit V. Hydration:** Ergogenic aids on physical activity. Hydration strategies to optimize physical activity capacity; importance of timing the nutrient and fluid intake. Ergogenic aids: Effect of ergogenic aids and other substances on physical activity; Sports drinks for endurance activities; nutrition supplements available for athletes.

## **Reference Books:**

- 1. Gordan.M.Wardlaw, Perspectives in Nutrition, fourth edition, Mc. Graw Hillcompanies. 1999.
- 2. Antia. F.P. and Philip Abraham, Clinical dietetics and Nutrition, fourth edition, Oxford University Press. 2012.
- 3. Srilakshmi. B., Dietetics, seventh edition, new age international (P) Limited.2014.
- 4. L.Kathleen Mahan, Sylvia Escott-stump, Krause's Food, Nutrition and Diettherapy, ninth edition, W.B. Saunders company. 2012.
- 5. Don Benordot, Advanced sports nutrition, second edition, Human Kinetics, 2012.

#### Elective II Nutrition in Sports and Fitness 4 Credits

**Course Objectives: Through this course the studnets will be able to u**nderstands about the role of nutrition in physical fitness, the nutritional screening in sports persons and energy needs, nutritional requirements and fluid needs in sports persons, dietary support during and after exercise and diettry support for sport persons of various age groups

**CourseOutcomes:** Enlightens knowledge on nutrition support during physical fitness and gain atains knowledge on nutritional screening and nutrients requirements for sport persons of various age groups

**Unit I. Effects of Physical fitness:** Physical fitness: Definition; benefits of physical activity

Physiology of exercise: body physiology to exercise, Muscle contraction; adaptation of muscle

Effect of physical exercise on cardio vascular and pulmonary system.

**Unit II. Aerobic & Anaerobic metabolism during exercises:** Energy sources for muscle use- ATP, phosphocreatine, glucose, fat and protein. Anaerobic metabolism during power exercises

Aerobic metabolism during endurance exercises.

**Unit III. Nutritional requirement in athletes: Athletes**: weight and body composition of athletes. Nutritional assessment and counseling for athletes. **Nutritional requirement**: Effect of differential intakes of macro nutrients (CHO, protein and fat) on the athletic endeavor. Nutrition needs of male, female, younger and older athletes.

# Unit IV. Nutritional needs during power, speed and endurance exercise

Nutritional needs and plans during power and speed exercise - before, during and after. Nutritional needs and plans during endurance exercise- before, during and after and Nutrition plan during combined power and endurance sports.

**Unit V. Hydration:** Ergogenic aids on physical activity; Hydration strategies to optimize physical activity capacity; importance of timing the nutrient and fluid intake. Ergogenic aids: Effect of ergogenic aids and other substances on physical activity; Sports drinks for endurance activities; nutrition supplements available for athletes.

#### **Reference Books:**

- 1. Gordan.M.Wardlaw, Perspectives in Nutrition, fourth edition, Mc. Graw Hillcompanies. 2015.
- 2. Antia. F.P. and Philip Abraham, Clinical dietetics and Nutrition, fourth edition, Oxford University Press. 2012.
- 3. Srilakshmi. B., Dietetics, seventh edition, New age international (P) Limited.2014.
- 4. L.Kathleen Mahan, Sylvia Escott-stump, Krause's Food, Nutrition and Diettherapy, ninth edition, W.B. Saunders company. 2015.
- 5. Don Benordot, Advanced sports nutrition, second edition, Human Kinetics, 2012.

#### SEMISTER VI Core Paper IX Nutraceuticals 4 Credits

**Course Objectives:** Understands about the nutraceuticals properties of foods. Understands about the functional role of nutraceuticals foods in disease management. Understands about the Nutraceutical aspects of food sources

**Course Outcomes:** Enlightens knowledge on nutraceuticals foods by means of understanding its properties, medicinal values and its health benefits. Promotes knowledge on nutraceutical foods sources in the management of health and healing diseases

# Unit I: Nutraceutical terminologies and emerging trends in nutraceuticals in India

Nutraceuticals: Definition, other terminologies, Categories- nutrients, herbals and dietary supplements; Safety and efficacy; regulatory aspects; emerging trends in nutraceuticals in India

**Unit II: Classification of nutraceuticals:** Classification of nutraceuticals, Action of nutraceuticals, Health benefits of functional ingredients existing infood- dietary fibre, oligosaccharides, sugar alcohols, poly unsaturated fatty acids, peptides and proteins, glycosides, isoprenoides and vitamins, alcohols and phenols, cholines, lactic acid bacteria, minerals and others.

**Unit III. Functional foods, Prebiotic and Probiotic foods:** Biological effects of commonly used functional foods: Dietary fibre, fenugreek seeds, omega -3 fatty acids. Functional food for CVD prevention, anticarcinogen turmeric and Coccinia indica. Prebiotics: Meaning, types, characteristics, medical benefits and safety. Probiotic foods: Meaning, characteristics, mechanism, spectrum of activity and health claim, dosage.

**Unit IV. Ligans, Flax seeds, Nutraceutical attributes of legumes:** Ligans: Introduction, dietary sources, role as nutraceutical in cancer, fibroids and kidney disease. Nutraceutical attributes of legumes: Role of starch, protein and micro minerals. Flax seeds: Introduction, nutrient and nutraceutical content, role in cancer prevention, hypolipemic and hypoglycemic effect.

# Unit V. Functional dairy foods, Nutraceutical aspects of fruits and vegetables, spices herbs

Functional dairy foods: Bioactive peptide- definition, sources; probiotic and bioactive peptide based functional foods. Nutraceutical aspects of fruits and vegetables: Functional components phytochemicals, phenolic compounds and antioxidants and their health benefits. Nutraceutical attributes of spices; herbs commonly used as nutraceuticals and antioxidant rich herbs.

# **Reference Books:**

- 1. Kamal G.Nath, D. Vijayalakshmi, Nutraceuticals: Challenges and opportunities in 21st century, Agrotech Publishing Academy, Udaipur. 2014.
- 2. S. Mangaraj, M.K. Tripati, Nawab Ali, Handbook of Nutraceuticals and functional foods- Soybean as an example, Satish serial publishing house, Delhi. 2013.

- 3. Handbook of Nutraceuticals and Functional Foods, Second Edition Edited by Robert E.C. Wildman, CRC Press Taylor and Francis Group, 2006.
- 4. Nutrigenomics and Nutrigenetics in Functional Foods and Personalized Nutrition, Lynnette R. Ferguson, CRC Press Taylor and Francis Group, 2013.

# Core Paper X Food Microbiology 4 Credits

**Course Objetcives:** The student is expected to learn and undersand about the history of microbiology and principles of food spoilage, about the importance of bacteria, mold, yeast and virus in food microbiology, about the food spoilage by microbial contamination and about the microorganisms in water to identify water portability

**Course Outcomes:** Students attains understanding the underlying cause of food spoilage. Promotes knowledge on beneficial effects of microorganisms. Enlightens the skills in identify water portability by means of understanding water microorganisms

# Unit I. Introduction to the History of Microbiology & principles underlying spoilage

Introduction and History of Microbiology - The theory of spontaneous generation, gene theory of disease, Louis pasteur's experiment. Different terminology of Heterotrophic nutrition, autotrophic nutrition, saprophytic, holozoic, host, culture, parasite. General principles underlying spoilage- fitness and unfitness of food for consumption, causes for spoilage, factors affecting kinds and number of micro organism in food, factors affecting the growth of micro organism in food

**Unit II. Bacteria, Mold, Yeast, Virus , Algae : B**acteria - Morphology, reproduction, growth curve, nomenclature, genera of bacteria important in food microbiology. Observation of motility of bacteria in bottle milk. Mold - Morphology, reproduction, physiology and nutrition, genera of mold important in foods. Demonstration of mold growth in bread. Yeast - Morphology, reproduction, classification, physiology and nutrition, process of hybridization, importance of yeast in food. Observation of yeast cells. Virus - Occurrence, morphology, reproduction, human viral disease caused by virus. Algae - Occurrence, morphology, reproduction, importance of algae.

# Unit III. Micro organisms causing spoilage in cereals, fruits, vegetables and fleshy foods

Contamination and kinds of micro organisms causing spoilage of cereal products- grains, flour, baked products and cake. Contamination and kinds of microorganisms causing spoilage of fruits and vegetables and their products- fruit juice, pickles. Contamination and kinds of microorganisms causing spoilage of fleshy foods- meats, poultry and fish. Observation of milk spoilage.

**Unit IV.** Micro organisms causing spoilage in eggs, milk, fats, oils, bottled beverages, spices and condiments; Food borne diseases - contamination and kinds of micro organisms causing spoilage of eggs and milk and milk. Products- cream, milk frozen desserts and butter. Contamination, kinds of micro organisms and spoilage of fats and oils, bottled beverages, spices and condiments. Food poisoning, food infection and food borne diseases. Microorganism in air, air borne diseases.

**Unit V.** Water Micro-organisms, Destruction of bacteria: Micro-organisms in Water - sources, bacteriological examinations, total count, test of E.Coli, purification of water, water borne diseases. Micro-organisms in sewage and sewage disposal. Destruction of bacteria- sterilization, physical agents, light, desiccators, electricity, heat andchemical agents. Visit to micro lab to learn most probable number.

# Core Practical IV Food Microbiology 4 Credits

- 1. Study and care of Microscope.
- 2. Study of equipment in a microbiology lab.
- 3. Preparation of laboratory media and special media, cultivation of bacteria, yeasts andmoulds.
- 4. Staining of bacteria: gram-staining.
- 5. Observation of bacteria by the simple monochrome staining method (Hay infusion culture or milk)
- 6. Observation of motility of Bacteria by hanging drop method (E. coli and Proteus)
- 7. To observe common pathogenic bacteria (any6- Permanent slides)
- 8. Observation of fungi on different food material and culture (PDA medium)
- 9. Cultivation and identifications of important molds and yeast in food items.
- 10.Demonstration of available rapid methods and diagnostic kits used in identification of microorganisms or their products.
- 11.Visits (at least two) to food processing units or any other organization dealing with advanced methods in food microbiology
- 12.To observe common pathogenic protozoa (Permanent slides of Entamoebahistolitica andplasmodium vivex

#### Elective II Food Packaging 4 Credits

**Course Objectives: U**nderstands about the importance of food packaging, Understands about the importance of food packaging techniques, Understands about the importance of food packaging materials and role in food industry, Understands about the importance of food packaging in increasing shelf life of food, Understands about the importance of food packaging laws in maintaining food safety

**Course Outcomes:** Enlightens the knowledge about the food packaging materials and promotes the understanding about the role food packaging techniques in food industry. Promotes the understanding about the role of food packaging in increasing shelf life of food

<b>Unit I. Functions and Classification of food packaging:</b> Definition, functions and requirements for effective packaging, Classification of packaging -Primary, secondary and tertiary packaging and flexible, rigid and Semi- rigid packaging
<b>Unit II. Packaging materials and methods:</b> Types of packaging material - glass, metal, plastics, paper, flexible laminates, bio-degradable, self heating food packaging - uses, merits and drawbacks. Packaging Methods and Performance: Retortable plastic packaging, Aseptic packaging; Modified atmosphere packaging (MAP); Time-Temperature Indicators for food quality. Storage and distribution – primary, secondary and tertiary containers, shipping containers. Polymer Nanomaterials for food Packaging.
<b>Unit III. Food Labeling</b> , <b>Consumer behavior,Advertising -</b> Colours, graphic design, printing and food labeling. Consumer behaviour purchase habits, motives and Markets and prices. Advertising – types, media and its role
<b>Unit IV: Packaging specification and testing</b> : Packaging specification and control of packaging quality. Shelf life theory and testing packaging materials (glass, flexible packaging materials). Food and food packaging interaction
<b>Unit V. Food Packaging Laws and Regulations:</b> Environmental Consideration in Packaging Disposing of Food Packaging Materials, and Food Package Laws and Regulations
<ul> <li>Reference Books:</li> <li>1. Sacharow, S., Griffin, R.C (2000). Food Packaging. AVI Publishing Company, West Port, Connecticut.</li> <li>2. Davis, E.G (2004). Evaluation of tin &amp; plastic containers for foods. CBS Publishers, New Delhi.</li> <li>3. Cruess, W.V (2003). Commercial Fruit &amp; Vegetable Products. Allied ScientificPublishers, New Delhi.</li> <li>4. Potter, N. N., Hotchkiss, J. H (2000). Food Science .CBS Publishers, New Delhi.</li> <li>5. Raj, G. D. Encyclopaedia of Food Science, Vol 2. Anmol Publications PVT Ltd, New Delhi.</li> <li>Food product Development and Quality Control</li> <li>4. Control</li> </ul>
<b>Course Objectives:</b> Understands about influencing factors and criteria in launching new product, Understands about organo- leptic testing as a tool in launching new product, Understands about specification and technology in development of new pro- duct,Understands about quality assurance program in controlling quality of new product,Understands about regulations in
2

controlling quality of new product
<b>Course Outcomes:</b> Students attains understanding on organoleptic testing, specification and technology in launching new product. Enlightens knowledge on quality assurance program and regulations in controlling quality of new product
<b>Jnit I. Understanding New food product development:</b> New food product development - Definition, factors shaping new product development, social concern, health concern Impact of market place influence and technology. Information required prior to launching a new product.
<b>Jnit II. Food product development tools: F</b> ood product development tool: Organoleptic testing panels, Panels - primary ensory panels and secondary sensory panels; Research guidance panels- purpose, panel organization, utility of results. Inter- ocking activities of people and organization.
Jnit III. Role of New technologies on Product development: Types of new products, role of new food product in food- company.Existing competitor product- idea sources, "must have"- "would like" specifications some minor new technology for existing factory new entry using existing technology in existing factory , steps in the development of new product- concept cesting, process development, public health clearance, packaged product storage studies, develop advertising claims, pre pro- duction runs, market research, timing.
Jnit IV. Role of government and industry in food quality control: Quality control: Need, role of government and industry n quality control. Design of company quality assurance program, objectives of quality assurance activity. Raw material quality assurance, in-process quality assurance and finished product quality assurance.
Jnit V. Regulations in food quality control: FAO/WHO Codex Alimentarious commission, PFA, AGMARK, BIS, FPO, CPA, fair

average quality (FAQ) specifications for food grains. ISO 9000 series;HACCP- background, principles, benefits and limitations; FSSAI.
<ul> <li>Reference Books:</li> <li>1. Norman W. Desroisier, James N. Desrosier, The Technology of FoodPreservation, fourth edition, CBS Publishers and distributors, Delhi.</li> <li>2. Mark Clute, Food Industry Quality Control Systems, CRC Press, 2008.</li> <li>3. InteazAlli, Food Quality Assurance: Principles and Practices, CRC Press, 2003.</li> <li>1. InteazAlli, Food Quality Assurance: Principles and Practices, CRC Press, 2003.</li> <li>3. InteazAlli, Food Quality Assurance: Principles and Practices, CRC Press, 2003.</li> <li>4. Credits</li> </ul>
<b>Course Objectives:</b> Understands about the Basic principles of Food Safety and personal hygiene Understands about the Food Safety Management System, Understands about the Food toxicology, Understands about the Biological Toxins and Adulterants in foods, Understands about the Chemical Toxins and Microbial Toxins
<b>Course Outcomes:</b> Enlightens student to understand about the Food Safety and personal hygiene management. Promotes knowledge about the Food toxins Adulterants in foods
<b>Unit I: Basic principles of Food Safety and personal hygiene:</b> Food contamination: concept and definition. Sources of contamination and components of hygiene - personal hygiene, food hygiene, environmental hygiene, unit hygiene. Methods of Sanitation and Hygiene - sterilization and disinfection using heat and chemicals, waste product handling and control- Solid and liquidwaste disposal and control of infestation- Rodent control
Unit II. Food Safety Management System (FSMS)

- - •
- •
- •
- Good Practices/ PRPs HACCP , GMP, GHP Management Element / System Statutory and regulatory requirements Communication Certification HACCP, ISO 22000, FSSC 22000 •

# **Unit III : Introduction to Food Toxicology** 211

- Importance of Food toxicology
- Determining Toxicity
- Dose Effect and Dose Response

# **Unit IV : Biological Toxins and Chemical Toxins**

- Naturally occurring toxins in foods
- Toxins from processed foods
- Seafood toxins
- Various and its testing food adulterants
- Chemicals used for pest management during farming, Storage and transportation (Pesticides) – Organo Chlorines,
- Organophosphates, carbamates
- Heavy metals Cd, Pb, Ni, Hg, Tin

# Unit V Microbial Toxins–Occurance, Symptoms, Prevention

- Cholera toxin
- Botulinum toxin
- Tetanus toxin
- Toxin form E. coli (0157:H7)
- Staphylococcus enterotoxin and Mycotoxins

# **Reference Books:**

- 1. FSSAI. (2016) Manual of Fodd safety management System, FSS 2006,
- 2. Fernandes M and Rose A. (2013) Persistent Organic Pollutants and Toxic Metals inFoods. Elsevier Publication
- 3. Deshpande S. S. (2013) Handbook of Food Toxicology ebook (Free Down Load)
- 4. Roday S. (2011) Food Hygiene and Sanitation, 2nd Edition, Tata McGraw Hill

### Elective III Food Analysis 4 Credits

**Course Objectives:** Understands about the Different analytical Methods of estimating moisture and ash in the laboratory, Understands about the Different analytical Methods of estimating lipids in the laboratory, Understands about the Different analytical Methods of estimating proteins, carbohydrates and vitamins in the laboratory, Understands about the Different analytical Methods of estimating enzymes in the laboratory and understands about the Different analytical Methods of estimating pigments in the laboratory

**Course Outcomes:** Students attains knowledge over Different analytical Methods of estimating nutrients in the laboratory. Promotes knowledge over Different analytical Methods of estimating enzymes and pigments in the laboratory

# Unit I: Analysis of Moisture and Ash

- Reasons for Analyzing Foods, Properties Analyzed, Choosing an analytical Technique
- Determination of Moisture Evaporation methods -Convection and forced draft ovens, Vacuum oven, Microwave oven, Infrared lamp drying
- Distillation Methods Dean and Stark Method
- Physical Methods -Spectroscopic Methods, Vaporpressure methods, Thermo- gravimetric methods, Calorimetric methods
- Ash and minerals Sample Preparation, Dry Ashing, Wet Ashing, Low Temperature Plasma Ashing,
- Determination of Water Soluble and Insoluble Ash and Comparison of Ashing Methods

# Unit II - Analysis of Lipids

- Determination of Lipids in Foods Sample Selection and Preparation
- Determination of Total Lipid Concentration SolventExtraction methods
- Non-solvent Liquid Extraction Methods-Babcock Method, Gerber Method, Detergent Method
- Chemical Techniques- Iodine Value, SaponificationNumber, Acid value, Peroxide value,

# Unit III Analysis of Proteins, Carbohydrates and Vitamins

- Analysis of Proteins- Introduction, Determination of Overall Protein Concentration-Kjeldahl method
- Analysis of Carbohydrates- Introduction
- Methods of Analysis (monosaccharide, disaccharide andoligosaccharide)-Sample Preparation, Chemical methods, Titration Methods, Colorimetric Methods
- Physical Methods Polarimetry, Density
- Analysis of Polysaccharides and Fiber Gravimetric
- Methods (Crude Fiber Method), Total, insoluble and soluble fiber method
- Analysis of Vitamins Fat soluble and water soluble

# **Unit IV Analysis of Enzymes**

- Introduction Definition, classification and chemical nature
- Properties of enzymes mechanism of action; methods of assay;
- Effect of temperature, pH and enzyme substrate concentrations;
- various methods of inactivation; enzymes as catalysts; enzymes as proteins; isoenzymes and coenzymes important enzymes of foods,
- Enzymes involved in food deterioration , types/nature of reactions catalysed and preventive measures,
- Enzymes as aids in food processing operations types/nature of reactions, catalysed and economical significance,

# **Unit V Analysis of Pigments**

- Natural pigments, their occurrence and characteristic properties
- Carotenoids, their structure, occurrence and importance in food
- Anthocyanin, flavone, their occurrence in food, degradation products in food and importance,
- Chlorophyll, their r occurrences, characteristic properties, degradation during food processing
- Methods of detection of various natural pigments carotenoids, chlorophyll, anthocyanins,

#### **Reference Books**

- 1. Mark Clute, Food Industry Quality Control Systems, CRC Press, 2008.
- 2. InteazAlli, Food Quality Assurance: Principles and Practices, CRC Press, 2003.
- 3. Nielsen, S. Suzanne, Introduction to Food Analysis, 2010.
- 4. S. Ranganna, Hand book of Analysis and Quality Control for Fruit and Vegetable Products, 1986.
- 5. Fennama, Fod Chemistry, Fourth edition, CRC press, 2007

# **BSc Psycology**

#### **Course Overview**

The B. Sc Psychology is an undergraduate course. This course will start with a basic overview of Understanding human behavior in General psychology and Developmental psychology. Also the involved in the development of memory, language, cognition, perception, executive functions, and attention would be studied. The disorder use to study Abnormal psychology, include personality disorder, developmental disorder, and mental retardation, it would be discussed in detail. An emphasis industrial psychology is also laid on the relation to psychology. The course work also focuses on the socio-psychology components of decision-making, etc. A separate paper is dedicated to counseling and guidance, involving the counseling methods, types of counseling its relation to psychology. The aim is to provide students to observe and understand human behaviors and conduct assessment and give counseling to them. Psychology is the scientific study of the human mind and its functions, especially those affecting behavior in a given environment. The duration of the course is three years and it is career orienting nature that opens a lot of job scopes for them after its successful completion.

# Duration: 3 years

Level: Undergraduate

# Eligibility: A Pass in II PUC / 10+2 or any equivalent Course with Biological Science and Arts Background from Standard School.

#### How B. Sc Psychology Course beneficial:

- The bachelor degree course is beneficial to deal with patients like counseling patients and clinical patients.
- They can find jobs in Hospitals, Psychiatric Centers, Rehabilitation Centers,

Schools (School counselor), and NGO.

• The course gives good base for further studies like M.Sc Cognitive Neuroscience, M.sc Psychology, M. Sc Clinical Psychology, and M.Sc applied Psychology.

**Course Outcome**: As a result of this course experience a student should be able to:

- Describe the scientific bases of psychology
- Explain basic psychological concepts and principles
- Understand the variety within the field of psychology
- Know the basic terms of each major area of psychology
- Analyze and critique the major psychological theories
- Successfully study a more specialized area of psychology

# **B. Sc Psychology Employers Are:**

- Hospitals
- Psychiatric centers.
- Education Institutions.
- Rehabilitation Centers
- NGO

# **B. Sc Psychology Job Types**

- Educational Counselor,
- Counselors' in (Hospital, Psychiatric centre, Schools, Rehabilitation Centers and Ngo's)

**Eligibility:** A Pass in II PUC / 10+2 or any equivalent Course with Biological Science and Arts Background from Standard School.

## Advance Course in B. Sc Psychology

- M. Sc Cognitive Neuroscience ,
  - M. Sc Psychology,
  - M. Sc Clinical Psychology,
  - M. Sc Applied Psychology.
  - MS in Any Universities Abroad
# BSc Psycology Examination Scheme

			SEMES	STER I			
					Deemed to b		
Part		Study Components and Code	Paper Dur. in Ho urs	Hr s/ we ek	Dur .in Hours	CIA	
I		Part I	English I	6	3	25	
II		Part II	English I/Kannada I/Tamil I/French I/Tamil I.	6	3	25	
III		Core Paper I	General Psychology-I	4	3	25	
		Core Practical I		4	3	25	
		Allied I	Basics of Biostatistics	3	3	25	
		Allied Practical I		3			
IV		Environmental Stud- ies	Environmental Studies	2	2	20	
			SEMES	TER II			
Ι	Par	tI	English II	6	3	25	Γ
II	Part II		English II/ Kannata II/ Tam- il II/ French II	6	3 25		
III	III Core paper II		General Psychology-II	4	3 25		

	Core Practical II	Practical II		4		3	25
	Allied II	Nutritional and Health Psy- chology		3		3	25
	Allied Practical I & II					3	20
SEMESTER III							
I	Part I	English III	6		3		25
II	Part II	English III/Kan- nada III/ Tamil III/ Hin- dI III/ French III	6		3		25
III	Core Paper III	Develop- mental Psychol- ogy-I	4		3		25
	Core Paper IV	Social Psychol- ogy	ocial sychol- gy 4		3		25
	Core Practical	Practical III	4	,	3		25

				SEMESTER I
75	100		4	PART-I ENGLISH I
	Outc	ome	of the S	Subject
50	These	e cou tuder	rses are nts	designed to develop the communication and vocabulary skills in
50	Úpon siona	com I con	pletion o nmunicat	f the course, the students have sufficient knowledge for profes- ion to excel in the chosen profession
30	Ðĥit	- 1:	Passage	es 1 to 5.
	<b>9</b> 25	- 2:	21	of Nouns
	•	Cor	rect Use	of Pronouns
	Unit	- 3:		
	•	Cor	rect Use	of Adjectives
75	100	4 <sup>Cor</sup>	rect use	Of The Verb
	Unit	- 4:	Roots ( <i>I</i>	to F)
	Unit	- 5:	Roots (O	G to N)
75	100	4		PART-II ENGLISH I
75	100	4		
75	100	4		
75	100	4		

#### Unit - 1: Passages 1 to 5

#### Unit - 2: Poems

- "When In Disgrace" by Shakespere
- "Daffodils" by William Wordsworth
- "Obituary" by A K Ramanujan

#### Unit - 3: Prose

- "The Ultimate Safari" by Nadine Gordimer
- "The Gift of The Magi" by O ' Henry

Unit – 4: Poems

- "Because I Could Not Stop for Death" by Emily Dickenson
- "After Apple Picking" by Robert Frost
- "Sonnet The Lotus" by Toru Dutt

Unit – 5: Prose

- "The Face On The Wall" by E V Lucas
- "Kabuliwala" by Rabindranath Tagore

#### ಪತ್ರಿಕೆ- 1: ಸವಿಸ್ತರ -ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 1

ಭಾಗ – 1

ಪದ್ಮಗಳ	ಓದು	ಮತು	ವ್ರಾಖ್ಯಾನ
2)		•	2) 2)

1.	ಕನ್ನಡಿಗರ ತಾಯಿ	:	ಗೋವಿಂದ ಪೈ
2.	รอเอี้ธ์	:	ಬಿ.ಎಂ.ಶ್ರೀಕಂಠಯ್ಯ
3.	ಶ್ರೀಸಾಮಾನ್ಯನ ದೀಕ್ಷಾಗೀತೆ	:	ಕುವೆಂಪು
4.	ಭೂಮಿತಾಯಿಯ ಚೊಚ್ಚಲಮಗ	:	ದ.ರಾ.ಬೇಂದ್ರೆ
5.	ರಂಗವಲ್ಲಿ	:	ಮ.ತಿ.ನರಸಿಂಹಾಚಾರ್
6.	ಸಂಬಳದ ಸಂಜೆ	:	ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
7.	ಯಾವ ಹಾಡ ಹಾಡಲಿ	:	ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
8.	ನಾವೆಲ್ಲರು ಒಂದೇ ಜಾತಿ	:	ಗೋಪಾಲಕೃಷ್ಣ ಅಡಿಗ
9.	ರಾಮನ್ ಸತ್ತ ಸುದ್ದಿ	:	ನಿಸಾರ್ ಅಹಮದ್
10.	ಅನಾಥೆ	:	ಸುಕನ್ಯಾ ಮಾರುತಿ
11.	ನೀವೆಲ್ಲಿಯವರೋ	:	ಜಂಬಣ್ಣ ಅಮರಚಿಂತ
12.	ಯುದ್ಧ	:	ಸವಿತಾ ನಾಗಭೂಷಣ

#### ಭಾಗ – 2

ಗದ್ಯ ಭಾಗ – ಪ್ರಬಂಧಗಳು

1.	ಗರುಡಗಂಬದ ದಾಸಯ್ಯ	:	ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
2.	ದೇವರು ಮತ್ತು ಮನರ್ಜನ್ಮ	:	ಎಚ್.ನರಸಿಂಹಯ್ಯ
3.	ಮೋಕ್ಷ ಹುಡುಕುತ್ತ ಪ್ರೀತಿಯ ಬಂಧನದಲ್ಲಿ	:	ಪಿ.ಲಂಕೇಶ್
4.	ಮೊಬೈಲ್ ಠೇಂಕಾರದ ಜೇನ್ನೊಣಗಳ ಝೇಂಕಾರ	:	ನಾಗೇಶ್ ಹೆಗಡೆ
5.	ಆಗಸ್ಟ್–6 – ಶಾಂತಿದಿನ – ಶ್ವೇತಭವದನದ	:	ನೇಮಿಚಂದ್ರ
	– ಮುಂದೆ 20 ವರ್ಷ		

#### ಭಾಗ – 3

ಆಡಳಿತ ಕನ್ನಡ

- 1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ, ಸ್ವರೂಪ, ಲಕ್ಷಣ
- 2. ಆಡಳಿತ ಕನ್ನಡ ಬೆಳೆದು ಬಂದ ದಾರಿ (ಆಡಳಿತ ಕನ್ನಡದ ಇತಿಹಾಸ)

#### ಭಾಗ – 4

- ಆಡಳಿತ ಕನ್ನಡ ಪ್ರಾಯೋಗಿಕ ಬರವಣಿಗೆ
- 1. ಸರ್ಕಾರಿ ಪತ್ರದ ವಿವಿಧ ಅಂಗಗಳು ಮಾದರಿಯೊಡನೆ

- 2. ವಿವಿಧ ಸರ್ಕಾರಿ ಪತ್ರಗಳು
  - ಅಧಿಕೃತ
  - ಅರೆ ಅಧಿಕೃತ
  - ಅಧಿಕೃತ ಜ್ಞಾಪನ
  - ಸುತ್ತೋಲೆ

ಭಾಗ – 5 ಪದ್ಯಗಳ ಮರುವ್ಯಾಖ್ಯಾನ ಮತ್ತು ವಿಮರ್ಶಾತ್ಮಕ ಚರ್ಚೆಗಳು

## PART-III

### **Core Paper-I**

### SEMESTER-I

## GENERAL PSYCHOLOGY-I 4 Credits

**OBJECTIVES:** Students to understand the various schools and models in psychology, and the Concept of Sensation, perception and their principles.

**OUTCOME:** After Completion of the syllabus students will be able to Describe the scientific bases of Psychology.

## UNIT – I

## **INTRODUCTION AND METHODS**

Modern psychology- Definition- Schools: Structuralism-Functionalism-Psychologysis-Behaviourism-Humanistic and Psychology-Major Sub field of psychology-Methods: Introspection-Observation-Survey-Experimentation-Case Study-Correlation Research-Heredity and Behavior.

#### UNIT – II SENSATION AND PERCEPTION

Sensation-Meaning-Threshold-Adaptation-Vision-Hearing-Touch and Skin senses-Smell and Taste. Perception-Meaning – Organizing Principles- Constancies-Illusion-Pattern Perception-Distance Perception-Extra Sensory Perception.

## UNIT – III

## STATE OF CONSIOUSNESS

Biology Rhythms-Waking States of Consciousness- Sleep-Functions of Sleep-Dreams. Altered State of Consciousness: Hypnosis –Drugs-Meditation.

#### UNIT – IV LEARNING

Definition-Classical conditioning-Basic Principles-Operant Conditioning-Reinforcement-Basic Principles-Learned Helpless-Observation learning-Insight Learning.

#### UNIT – V MEMORY AND FORGETTING

Memory: Meaning-Models-Sensory Memory-Short term memory-Long Term Memory. Forgetting-Causes: Decay Hypothesis-Inference-Retrieval Failure-Amnesia-Memory and the brain. Improving Memory.

## REFERENCES

- 1. Baron.A.R(2013). Psychology. (7TH Ed,)New Delhi: Pearson Education.
- 2. Santrock, J.W., (2005)Psychology Essentials. New Delhi: Tata McGraw Hill Publishi ng company Limited.

#### PART-III

**Core Practical-I** 

SEMESTER-I

### PRACTICALS-I (Any 5 experiments) 4 Credits

#### **OBJECTIVES:**

Students to Understand the Sensation and all sense Modalities, Perceptual process with illusion , depth and perception.

#### **OUTCOMES:**

To enable the students to practice the knowledge to assess individuals perception, sensation and learning in day to day Life.

- 1. Depth Perception
- 2. Insight learning
- 3. Trial and error learning
- 4. Span of attention
- 5. Muller Lyer Illusion
- 6. Temperature attitude scale
- 7. Color blindness

#### REFERENCES

- 1. Kuppusamy B(1954): Elementary In Psychology, Madras,Oxford University Press.
- 2. Postman And Egn, J.P(1985): Experimental Psychology, New Delhi, Kalyani Publication

#### Allied-I

## SEMESTER-I

## ALLIED PAPER-I : BASICS OF BIOSTATISTICS 3 Credits

#### **Outcome of the Subject**

This course imparts the knowledge of basic statistical methods to solve problems Students are taught to operate various statistical software packages By the end of the course, the students are able to appreciate the importance of statistics in research and prepares them for a career in research

#### **Unit1: Introduction to Statistics:**

Definition and Application Of Statistics, Qualitative Data, Quantitative Data, Frequency Distribution, Cumulative Frequency, Diagrammatical Representation Of Statistical Data(Bar, Pie), Graphical Representation Of Frequency Distribution (Histogram, Frequency Polygon, Cumulative Frequency Curves).

## **Unit2: Descriptive Statistics**

Measure of Central Tendency: Mean, Median, Mode, Geometric Mean (Merits And Demerits) ,Measure of Dispersion: Range, Standard Deviation, Variance, (Merits And Demerits), Co-Efficient of Variation.

## Unit3: Probability

Trial, event, sure event, random event, Sample space, Definition of probability, mutually exclusive events, Independent event, Law's of Probability - simple problems, Normal probability curve.

## Unit4: Hypothesis Testing:

Hypothesis, Types of Hypothesis, Level Of Significance, Type I and Type II Error, Standard Error, Degrees Of Freedom, Chi Square Test, Student's t Test: One Sample t Test, Paired t Test.

## **Unit5: Correlation and Regression**

**Correlation:** Definition, Types Of Correlation, Karl Pearson's Coefficient Of Correlation, Simple Linear Regression, One Way ANOVA.

## **References:**

- 1. Fundamentals of Mathematical Statistics: S.C. Gupta And V. K. Kapoor
- 2. Fundamentals of Statistics: S.C. Gupta
- 3. Fundamentals of Biostatistics: Veer Bala Rastogi

## COMPULSORY PAPER: ENVIRONMENTAL STUDIES

## **Outcome of the Subject**

The main objective of this paper is to create awareness among the students about the environment By the end of the course, the students will have a better appreciation for the environment and become responsible citizens

## Unit-I:

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

## Unit-II:

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

## Unit- III:

Environmental Pollution: Air pollution; Water pollution; Soil pollution

#### **References:**

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore

- 2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- 3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad 380 013, India,
- 4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
- 5. Clark R.S., Marine Pollution, Clanderson Press Oxford
- 6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
- 7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- 8. Down of Earth, Centre for Science and Environment

#### SEMESTER II

#### PART-I ENGLISH II

#### **Outcome of the Subject**

These courses are designed to develop the communication and vocabulary skills in the students Upon completion of the course, the students have sufficient knowledge for professional communication to excel in the chosen profession

#### Unit - 1: Passages 1 to 4

#### Unit - 2: Grammar

- Correct Use of Adverbs
- Correct use of Prepositions
- Reported Speech

#### Unit - 3:

- Roots (O to T)
- Prefixes
- Suffixes

#### Unit - 4: Grammar

- Correct Use of Conjunctions
- Correct use of Articles
- Parallelism

#### Unit - 5:

- Roots (U to Z)
- New Words in English

#### PART-II ENGLISH II

- Unit 1: Passages 1 to 5
- Unit 2: Poems
  - "The Frog and The Nightingale" by Vikram Seth
  - "Ozymandias" by P.B Shelly

#### Unit - 3: Prose

- "Such Perfection" By R.K Narayan
- "Retrieved Reformation" by O" Henry

#### Unit - 4: Poems

- "Wild Swans At Coole" by W.B Yeats
- "Lucy Grey" by William Wordsworth
- "Stopping By Woods On A Snowy Evening" by Robert Frost

ಪತ್ರಿಕೆ - 2 : ಸವಿಸ್ತರ - ಅವಿಸ್ತರ ಪಠ್ಯಗಳು ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ - 2

Unit - 5: Prose

- "His Wedded Wife" by Rudyard Kipling
- "The Merchant of Venice" (trial scene) by Shakespere

ಭಾಗ – 1 ಸವಿಸ್ತರ ಪಠ್ಯ ನಾಟಕ – 1 1. ಕಾಕನಕೋಟೆ – ಮಾಸ್ತಿ ವೆಂಕಟೇಶ್ ಅಯ್ಯಂಗಾರ್

ಭಾಗ – 2

- ಅವಿಸ್ತರ ಪಠ್ಯ 1.
  - ಕಾದಂಬರಿ/ವೈಚಾರಿಕ ಬರಹ ಒಡಲಾಳ - ದೇವನೂರು ಮಹಾದೇವ

ಭಾಗ– 3

**Core-II** 

ಆಡಳಿತ ಕನ್ನಡ – 2

- 1. ಅರ್ಜಿ : ಸ್ವರೂಪ ಮತ್ತು ವಿವಿಧ ಬಗೆಗಳು
- ಕಡತ (ಫೈಲು)
  ಕಚೇರಿ ಕಾರ್ಯವಿಧಾನ ಮತ್ತು ಕಚೇರಿ ಟಿಪ್ಪಣಿಗಳು
- 4. ಸರ್ಕಾರಿ ಪ್ರಕಟಣೆ, ಜಾಹೀರಾತು (ಸ್ವರೂಪ–ರಚನೆ)

ಭಾಗ– 4 ಸವಿಸ್ತರ ಪಠ್ಯ ಕಾಕನಕೋಟೆ ನಾಟಕದಲ್ಲಿನ ಪಾತ್ರಗಳು, ಘಟನೆಗಳ ಸ್ರಾರಸ್ಯ ವಿವರಣೆ ಮತ್ತು ವಿಶ್ಲೇಷಣೆ

ಭಾಗ – 5 ನಾಟಕ ಮತ್ತು ಕಾದಂಬರಿಗಳ ಕುರಿತು ವಿಮರ್ಶೆ ಮತ್ತು ಚರ್ಚಾತ್ಮಕ ವಿಶ್ಲೇಷಣೆ

## **SEMESTER-II**

#### **GENERAL PSYCHOLOGY-II** Credit 4

PART-III

**OBJECTIVES:** To enable students to understand the meaning of cognition, motivation, and theories. and the nature of emotion theories and role in health. creativity, intelligence and its theories.

**OUTCOME:** After Completion of the syllabus students will should be able to explain basic psychological concepts and principles and able to apply the variety within the field of psychology.

## UNIT – I **COGNITION AND MOTIVATION**

Thinking : Concept- Reasoning- Problem Solving: Meaning- Methods- Artificial Intelligence. Language- Development-Motivation : Meaning-Theories of Motivation : Psychological Motives: Psychological Motives-Conflict-Frustration.

#### UNIT – II EMOTION, HEALTH, STRESS ND COPING

Emotion: Meaning-Physiological Changes-Theories-Expression Of Emotion. Health Psychology: Meaning – Stress: Nature-Major Causes-Affect-Management Of Stress. Behavioural And Psychological Correlates of Illness.

# UNIT – III

## **INTELLIGENCE AND CREATIVITY**

Intelligence: Meaning-Theories-Concept Of IQ-Extremes Of Intelligence-The Role Of Heredity And Environment- Emotional Intelligence-Components.Creativity: Meaning-Nature-Steps In Creative Thinking-Characteristics Of Creative People.

#### UNIT – IV PERSONALITY

Personality: Meaning-Psychoanalytic Approach-Neo Fraudians: Jung-Adler-Keren Horney-Erikson. Humanistic Theories: Rogers Self Theory-Maslow Theory. Trait Theory: Allports Theory-Cattels Theory-The Big Five Factors. Learning Approach To Personality.

## UNIT – V

## MEMORY AND FORGETTING

Memory : Meaning – Model –Sensory Memory-Short Term Memory-Long Term Memory. Forgetting : Meaning-Causes: Decay Hypothesis-Interference-Retrival Failure-Repression-Amnesia-Memory And The Brain-Improving Memory.

## REFERENCES

- 1. Baron.A.R(2013). Psychology. (7TH Ed,)New Delhi: Pearson Education.
- 2. Santrock, J.W., (2005)Psychology Essentials. New Delhi: Tata Mc Grw Hill Publishi ng company Limite

## **Core Practical-II**

## SEMESTER-II

#### PRACTICALS-II (Any 5 experiments) 4 Credits

**OBJECTIVES:** Students to understand the thinking and problem solving and Learn the Concept of Memory and Inhibition.

**OUTCOMES:** To enable the students to practice the knowledge to assess individuals memory, and problem solving skills.

- 1. Level of aspiration test
- 2. Sensation seeking scale
- 3. Kinesthetic sensitivity
- 4. Raos achievement motivation test
- 5. Immediate memory span

- 6. Mental Imagery questionnaire
- 7. Personality need inventory

## REFERENCES

- 1. Kuppusamy B(1954): Elementary In Psychology, Madras,Oxford University Press.
- 2. Postman And Egn, J.P(1985): Experimental Psychology, New Delhi, Kalyani Publications.

### Allied-II

### Semester-II

#### NUTRITION AND HEALTH IN PSYCHOLOGY 3 Credits

**OBJECTIVES:** To enable students to understand the Concept of Nutrition, Importance of Nutrition. How Nutrition involves in Mind and Health importance of Nutrition for ensuring adequate development.

**OUTCOMES:** After Completion of the syllabus students will should be able to Explain basic Nutrition and their principles and to Describe the how nutrition will help to develop growth.

### Unit-I

**Nutrition-**Science of Nutrition, Concept of Nutrition- Definition of nutrition, health, nutritional status and malnutrition. -RDA- Definition, factors affecting RDA and methods used for deriving RDA.-Minimum Nutritional Requirement and RDA -Formulation of RDA and Dietary Guidelines -Reference Man and Reference Woman.

#### Unit-II

**Carbohydrates-** Definition, composition, functions, maintenance of blood sugar levels, Requirement, Sources, digestion and absorption; Dietary fiber- Definition, Classification, physiological effects and sources.

#### Unit-III

**Proteins**- Definition, composition, nutritional classification of proteins and amino acids, functions, sources, requirements, digestion and absorption.

#### UNIT-IV

**Lipids**- Definition, composition, functions, sources, requirements, digestion and Absorption. Essential fatty acids – Definition, functions, sources and effects of deficiency.

#### Unit V

**Growth &development-**Growth &development from infancy to adulthood: Somatic, physical, brain and mental development, puberty, menarche, prepubertal and pubertal changes. Factors affecting growth and development. Importance of Nutrition for ensuring adequate development. Growth monitoring and promotion: Use of growth charts and standards, Preventions of growth faltering.

#### **Reference Books:**

- 1. Sumathi R. Mudambi, Rajagopal, M.V., Fundamentals of Foods and Nutrition, New Age International (P) Ltd, Publishers, Third edition, 1997.
- 2. SrilakshmiB., Nutrition Science, New Age International (P) Ltd, Publishers, Fifthmulti color edition, 2016.
- 3. MangalaKango, Normal Nutrition, Curing diseases through diet, CBS Publications, First edition, 2005.
- 4. Paul.S., Text Book of Bio-Nutrition, Fundamental and Management, RBSA-Publishers, 2003.
- 5. Sue Rodwell Williams, Nutrition and Diet Therapy, C.V. Melskey Co., 6 th edition, 2000.



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