Revised Curriculum

Department of Biological Sciences

Faculty of Applied Sciences

Rajarata University of Sri Lanka

<u>Study Programmes</u>

B.Sc. in Applied Sciences

B.Sc. Honours in Applied Biology in Biodiversity Conservation

B.Sc. Honours in Applied Biology in Fisheries and Aquaculture Management

B.Sc. Honours in Applied Biology in Microbiology

Recommended by Faculty Board of the Faculty of Applied Sciences at its 163rd meeting held on 29/10/2015

Approved by the Curriculum Development Committee of the Rajarata University Sri Lanka on 16/ 11/ 2015

Approved by the Senate of the Rajarata University of Sri Lanka at its 189th meeting held on 21/01/2016

Approved by the Council of the Rajarata University of Sri Lanka at its 205th meeting held on 26/06/2016

Submitted for the Approval for University Grants Commission, Sri Lanka

Contents Page

1. INTRODUCTION

1.1 Background

Faculty of Applied Sciences (FAS) of Rajarata University of Sri Lanka (RUSL) was inaugurated on the 10th of January, 1997 as the successor of The Central Province Affiliated University College (CPAUC) that was situated in Polgolla in the administrative district of Kandy. While FAS had been clearing up with upgrading of the students admitted to the CPAUC to the Graduate level, its first batch of proper undergraduate students was enrolled in November, 1997. After functioning for nearly 10 years at Polgolla, the Faculty was finally established in the premises of the main campus at Mihintale, on 16th January 2006 upon completion of Stage I of the building complex.

The FAS consists of two academic Departments *viz*. Department of Biological Sciences and Department of Physical Sciences. At present, three B.Sc. (General) Degree programmes, two B.Sc. (Special) Degree programmes, two B.Sc. (Joint Major) Degree programmes and three B.Sc. (4 year) Degree programmes are offered by the FAS.

The Department of Biological Sciences conducts a Degree Programme in Health Promotion and contributes to B.Sc. (General) Degree in Applied Sciences and conducts Special Degree programmes in three specialization areas: the specialization area being Biodiversity and Conservation, Fisheries and Aquaculture Management and Microbiology. All the Degree programmes are organized in course units system following the semester system. The medium of instruction and assessment is English from the first year. As such FAS conducts an intensive English programme and a regular English programme as a student support service.

1.2. Curriculum Revision and Modernization

The first curriculum in Biological Science studies was introduced in 1996 for the first intake of students. After several minor revisions and evolution of the curriculum, a major curriculum revision was done in 2006.

The academic staff of the Department of Biological Sciences decided in 2012 to embark on a major curriculum revision incorporating revised content and employing an array of teaching learning methods and assessments. This was driven by the fact that previous major curriculum revision had been done in 2005. This was commenced with collecting feedback information from various stakeholders including employers of graduates, alumni and students in order to carry out SWOT and GAP analysis required for the Quality and Innovation Grant (QIG) of Higher Education for the Twenty first Century (HETC) Project. The major activities in the direction of a revised and modernized curriculum were launched with the winning of QIG-HETC Project by the Biological Science Study Programme. Curriculum development workshops were held under the guidance of a consultant (Prof. Deepthi C. Bandara, Faculty of Agriculture, University of Peradeniya) appointed for the purpose with the participation of potential employers in public, private and NGO sectors, academia, students and alumni. These workshops were helpful in identification gaps in the curriculum which is in operation and to obtain suggestions for improvements to it. A graduate profile had been developed at the proposal writing stage with the contribution of ideas of the students. This graduate profile was further refined during the module development stage. The same consultant was appointed for module development. The new curriculum was oriented

towards Outcome Based Education (OBE) as also required by Sri Lanka Qualification Framework, and the teaching learning activities were also directed towards student centered learning. Following Graduate Profile was selected as expected outcomes of a graduate after following the biological sciences study programme.

On a completion of a degree, the skills that a student should possess,

- Intellectual skills (K)
- Practical skills (S)
- Numeracy skills (K)
- Communication skills (K/S)
- IT skills (S)
- Team work and interpersonal skills (A)
- Professional development and self-management skills (A/M)

Then seven outcomes are aligned with the 12 categories of learning outcomes identified by Ministry of Higher Education and stipulated in Sri Lanka Qualification Framework (SLQF) according to the K-SAM model (K: Knowledge, S: Skills, A: Attitudes and M: Mind set and Paradigm). The content, teaching learning methods and assessment methods were designed in accordance with achieving these outcomes. Subject Benchmark Statements, where available, were considered. The alignment of Courses has been done in such way that there is a gradual progression from fundamental theoretical knowledge to more advanced knowledge and applications. The courses offered in the Third year are optional, except one, and therefore a great flexibility is ensured respecting the choice of students allowing them to acquire knowledge and skills their chosen field in biology. The basket of courses in the Third Year consists of courses in Botany, Zoology, Biology, Biodiversity conservation, Fisheries and Aquaculture Management and Microbiology and also Interdisciplinary Courses.

The Department of Biological Sciences contributes to B.Sc. in Applied Sciences and conducts B.Sc. Honours Degrees (Applied Biology) in three specialization areas of Biodiversity Conservation, Fisheries Aquaculture Management and Microbiology. These degrees are offered in compliance with the SLQF standards. The volume of learning was calculated as 50 notional hours of learning for a credit and a minimum of 90 credits for B.Sc. in Applied Sciences and 120 credits for B.Sc. Honours Degrees. The volume of learning, learning outcomes, qualification descriptors and level descriptors are also in agreement with SLQF Levels 5 and 6.

All the courses were developed with relevant course capsule, course aim, course ILOs, lesson sequence, resources required, assessment strategy and references. A course organizer was also identified (Lesson sequence and the course organizer are not given in this document).

Course codes identify the subject or areas of study with a three letter prefix, followed by four numericals denoting the year of study (first digit), credit value (second digit) and the serial number (last two digits). The three letter prefix that are used to identify the subjects or subject areas are as follows: BOT- Botany, ZOO- Zoology, BIO- Biology, BDC-Biodiversity Conservation, FAM- Fisheries and Aquaculture Management, MIB- Microbiology. In addition to subject specific courses, a number of interdisciplinary courses have also been designed. They are identified by IDC code. The status of courses can be either compulsory (C) or optional (O).

The majority of the courses were developed by the academic staff of the Department of Biological Sciences and assistance of external experts from other universities and industries was utilized when necessary. Prof. L.P. Jayatissa, Prof. Kulasena Vidanagamage, Prof. Mangala de Silva, Prof. E.P. Saman Chandana, Prof. Upali Mampitiya, Prof. S. Chandrani Wijerathna , Dr. P.M. Wijerathna, Dr. Mangala Ganehiarachchi , Dr. Sampath Wahalna , Mr. Nimal Sumith Pathirana and Dr. Priyan Perera were some of the key contributors to the curriculum development effort.

The modules developed were presented to the key stakeholders such as employers in public, private and NGO sectors, students and alumni. The feedbacks and comments were utilized to further improve the curriculum. The final draft was sent to five specialists in the different subject areas, Botany, Zoology, Biodiversity Conservation, Fisheries and Aquaculture Management and Microbiology. These subject specialists were Prof. S. Chandarni Wijerathna, Professor Emeritus of Botany; Prof. Jayantha Wijerathna, Chair Professor, Department of Zoology, University of Kelaniya, Dr. U.K.G.K. Padmala, Senior Lecturer, Department of Zoology, Open University of Sri Lanka, Prof. Udeni Edirisinghe, Dept. of Animal Science, Faculty of Agriculture, University of Peradeniya and Prof. G.S. Vidanapathirana, Emeritus Professor of Microbiology. They perused the draft version and discussions were held with academic staff of the department.

1.3 Special Features of Modernized Curriculum

The most important feature of the new curriculum is its adherence to OBE model with emphasis on identifying and quantifying KSAM Knowledge, Skills, Attitudes, Mind-set). These four educational domains dissected to be in line with SLQF. In order to achieve this teaching learning activities have been selected so that the process is more student-centered. Each course contributes to a set Degree programme in a logical alignment which ensures continual student progression, as measured by the curriculum targeting on KSAM. The lesson sequence (Table 1) of each course is identified, together with related lesson ILO(s), teaching-learning method(s), expected attitudes and type of assessment where applicable. The KSAM of each course was estimated, by tabulating contributing ILOs and averaging (Table 2). The average contribution of each ILO of each course to KSAM values was mapped (Table 3) so that KSAM at end of each academic year and at the end of the course can be estimated. This provides a clear indication of curriculum targeting at the end of the biology study programme and how student progression at each level. The objectives and outline of each lesson shall be written and be approved by at a Departmental meeting before the beginning of each semester. One example each of Tables 1 and 2 and a template for Table 3 are given below. Table 4 given in the Annexure provided a complete picture of how each course has contributed to the program outcome.

Table 1. Lesson Sequence

Week No.	Lesson No.	Related ILO/s	Lesson Title	Theory hrs	Practical hrs	IL hrs	Teaching/ Learning Methods	Expected Attitudes	Assessments
1	1.1	1	Introduction: Refresher session of general microbiology with special reference to soil microbiology, soil as a special habitat-Soil structure and composition	1			Discussion, presentations	Cooperative learning	
	1.2	1	'Soil as a special habitat' contd - Substrate availability	1			as above	Self confidence	
2	2.1	2	Aspects of microbial diversity (Reading material will be provided in advance)	1		5	Question and answer session	Cooperative learning, Commitment	
	2.2	2	Approaches to microbial ecology Microbial community, Species composition and communities, Establishment and maintenance	1			pp presentations		
	2.3	3, 10	Preparation of Winogradsky column, Procedure and principles (Reading materials will be provided in advance)		3	5	Laboratory work	hardworking, Punctual,	Assessment of planning and practical skills, critical thinking, report writing (in class)
3	3.1	3, 10	Methods of studying soil microbial communities (Reading materials will be provided in advance)	1		5	Question and answer session	Cooperative learning, Commitment	
	3.2	3, 10	Isolation and characterization of soil microorganisms: sampling, preparation of samples for plating, slide culture		3		Laboratory work	Trusting, Self confidence, Open	Assessment of planning and practical skills, critical thinking,

								minded	report writing (in class)
4	4.1	4	Colonization and succession, Extreme environments,	1			pp presentation		
	4.2	4	Community stability (Homeostasis), Quantitative microbial ecology	1			pp presentation		
5	5.1	2, 4	Microbial Interactions (Reading materials will be provided in advance)			5	Essay writing	Punctual, Self-directed,	Assessment of essay (homework)
	5.2	2, 4	Microbial Interactions	2			Student presentation, discussion	Honest, Cooperative learning, Commitment	Assessment of presentations including peer assessment by students
6	6.1	3,10	Designing and carrying out experiments to isolate soil microorganisms according to physiological properties		5		Laboratory work	Confidence, Proactive, Tolerance	Assessment of planning and practical skills, critical thinking, report writing (in class)
7	7.1	1, 2, 3	Biochemical Ecology of Soil Microbes: Introduction, The microenvironment	1			pp Presentation		
	7.1	1, 2, 3	Biochemical Ecology of Soil Microbes: (Cont) biochemical influences	1			pp Presentation		
8	8.1	1, 2, 3	Biochemical Ecology of Soil Microbes: (Cont) Influence of pores, clays, plant roots, plant residues, animal residues	1			pp Presentation		
	8.2	2,4,10	Isolation of antibiotic producing organisms from soil		4		Laboratory work	Proactive, Time	

								management	
9	9.1	1, 2, 3, 4	Mid-semester examination				Short answer questions,		Formative assessment of ILO's 1-4
	9.2		Reflection on ILO's 1-4	1			Marking and discussion of answers		
10	10.1	5	Survival strategies of soil microorganisms	1			pp presentation		
	10.2	6, 7, 8	Essay writing i. Disease suppressive soils, ii. Use of soil inoculation for improving plant nutrition, iii. Microbial inoculants as crop health enhancers, iv. Factors affecting root colonization by microorganisms and other topics (one topic per student) (Topics to be given 1 week ahead)			10	Referencing, Analysis and Summarizing.	Honest, Hardworking, Respectful to nature	Evaluation of essays (homework)
11	11.1	6,7	i. Disease suppressive soils, ii. Use of soil inoculation for improving plant nutrition	2			Student presentations	Open minded, Decisive, Proactive	Assessment of presentations including peer assessment by students
12	12.1	7,8,9	iii. Microbial inoculants as crop health enhancers, iv. Factors affecting root colonization by microorganisms	2			Student presentations	As above	Assessment of presentations including peer assessment by students
13	13.1	5, 7, 8	Essay writing and presentation; i. Ultramicrobacteria (as a strategy for survival), ii. Plant growth promoting rhizobacteria, iii. Biological control of soil borne pathogens, (one topic per student)	2		10	Student presentations	Respectful to environment, Punctual, Honest, team spirit	Evaluation of essays (homework), Assessment of presentations including peer assessment by students

14	14.1	3, 7, 8	iv. Plant growth promoting rhizobacteria and other topics, v. Biological control of soil borne pathogens, vi. Metagenomics for soil microbial ecology	2			Student presentations	Save as above	Assessment of presentations including peer assessment by students
15			Class test, Reflection on ILO's 5-9	2			Marking answers to class test together with students and discussion	Respect, Honest. Tolerant, Confidence	Formative assessment of ILO's 5-9
Total				24	15	40			

Table 2: Course ILOs mapped in to Educational Domains

Course Name: xxx xxxxx

Outcome / ILO No.	KNOWLEDGE					SKIILS						ATTITUDE						MIND SET	
	1.1	1.2	1.3	2.1	2.2	3.1	3.2	4.1	5.1	6.1	7.1	8.1	9.1	10.1	10.2	11.1	11.2	12.1	12.2
1	√					√													
2	√					√													
3	√	√	√			√	√	√											√
4	√	√	√	√		√	√		√									√	√
5	√					√			√				√					√	√
6	√	√	√	√		√	√		√				√					√	√
7	√	√	√	√		√	√		√						√			√	√
8	√	√	√	√	√	√	√		√				√		√	√		√	√
9	√		√		√	√	√	√	√		√	√	√	√	√		√	√	√
Cumul-ative	9	5	6	4	2	9	6	2	6	0	1	1	4	1	3	1	1	6	7
Score	12.2	6.8	8.1	5.4	2.7	12.2	8.1	2.7	8.1	0.0	1.4	1.4	5.4	1.4	4.1	1.4	1.4	8.1	9.5
	% (26)					32.4% (24)						14.9% ()						17.6% (13)	

Four educational domains were identified in conformity with KSAM Model and with SLQF. Each domain was dissected into relevant outcomes in compliance with SLQF. The outcome numbers given in Table 2 are the same as those in SLQF document.

Table 3: Course contribution to Program Outcome (Graduate Profile)

Course Code	1.1	1.2	1.3	2.1	2.2	3.1	3.2	4.1	5.1	6.1	7.1	8.1	9.1	10.1	10.2	11.1	11.2	12.1	12.2
First Year																			
BOT1201	13.3	6.7	3.3	5.0	8.3	11.7	x	6.7	5.0	1.7	0.0	5.0	5.0	1.7	6.7	1.7	5.0	1.7	11.7
BOT1202	7.6	7.6	7.6	7.6	7.6	7.6	x	2.2	7.6	5.4	3.3	7.6	2.2	3.3	4.3	4.3	4.3	5.4	4.3
BOT 1203	12.7	7.6	7.6	6.3	8.9	8.9	x	3.8	5.1	0.0	1.3	3.8	5.1	6.3	5.1	3.8	3.8	5.1	5.1
ZOO 1201	6.7	0.0	13.3	0.0	6.7	6.7	x	0.0	6.7	0.0	0.0	26.7	0.0	6.7	0.0	13.3	0.0	0.0	13.3
ZOO 1303	11.1	11.1	0.0	11.1	7.4	7.4	x	3.7	7.4	3.7	0.0	0.0	0.0	7.4	7.4	7.4	3.7	0.0	11.1
ZOO 1104	10.5	0.0	5.3	2.6	7.9	2.6	x	2.6	2.6	10.5	0.0	10.5	2.6	7.9	7.9	7.9	2.6	10.5	5.3
BIO 1201	21.7	4.3	0.0	4.3	13.0	4.3	x	0.0	13.0	0.0	0.0	8.7	0.0	8.7	0.0	8.7	0.0	0.0	13.0
BIO 1202	12.7	11.1	7.9	12.7	7.9	12.7	x	6.3	3.2	3.2	3.2	0.0	0.0	3.2	0.0	0.0	4.8	6.3	4.8
IDC 1201	10.4	0.0	6.3	6.3	10.4	4.2	x	4.2	6.3	8.3	2.1	2.1	2.1	4.2	4.2	2.1	6.3	10.4	10.4
First Year Contribution to Graduate profile																			
	11.9	5.4	5.7	6.2	8.7	7.3	x	3.3	6.3	3.6	1.1	7.2	1.9	5.5	4.0	5.5	3.4	4.4	8.8
	K-37.9					S-21.7						A-27.3						M-13.2	

Contribution to Graduate Profile (B.Sc. in Applied Sciences)				
First Year	K-37.9	S-21.7	A-27.3	M-13.2
Second Year	K-37.8	S-26.0	A-25.7	M-10.5
Third Year	K-33.5	S-31.4	A-24.3	M-10.8
TOTAL	K-36.4	S-26.0	A-25.4	M-11.5

2. TEACHING STAFF AND CONTRIBUTORS TO THE COURSE DEVELOPMENT

Regular Staff

1. Prof. Sanath Hettiarachchi SH
2. Dr. Priyani. L. Hettiarachchi PLH
3. Dr. Manel Goonasekera MMG
4. Dr. T.V. Sundarabarathy TVS
5. Dr. T. Chathuranga Bamunuarachchige TCB
6. Dr. Sriyani Wickramasinghe SW
7. Dr. Rajnish P.G. Vandercon RV
8. Mrs. P. Neelamini Yapa PNY
9. Dr. Kanishka Ukuwela KU
10. Dr. Asanga Wijetunga AW
11. Mr. Ravindra L. Jayaratne RJ
12. Mrs. M.G. Theja H. Abayarathna TA
13. Mrs. Dilani K. Hettiarachchi DKH
14. Mr. Gayan D. Abeysinghe GDA
15. Dr. Ranjith Edirisinghe RE
16. Mr. M.A.M. Mohomad MM

Visiting/ Contract Staff

17. Prof. N. J. de Silva Amarasinghe NJS
18. Prof. L.P. Jayatissa LPJ
19. Prof. Kulasena Vidanagamage KV
20. Prof. Mangala de Silva MS
21. Prof. E.P. Saman Chandana EPS
22. Prof. Upali Mampitiya UM
23. Prof. S.C. Wijeyaratne SCW
24. Dr. W.H.A.P. Guruge WHP
25. Dr. P. M. Wijerathna PMW
26. Dr. Mangala Ganehiarachchi MGA
27. Dr. Sampath Wahala SW
28. Dr. Priyan Perera PP
29. Dr. Sansfica M. Young SY
30. Mr. Mahinda Samarakoon MS
31. Mr. P.A.C.T. Perera PAC
32. Mr. Nimal S. Pathirana NSP
33. Mrs. D.M.J. Dissanayaka JD
34 Dr. Naveen Wijesinghe NW

3. LIST OFCOURSES OFFERED BY THE DEPARTMENT OF BIOLOGICAL SCIENCES FOR B. SC. DEGREE PROGRAME IN APPLIED SCIENCES

FDN 1201 General English and FDN 1202 Introduction to Computers are also compulsory courses for Biology students and are offered by the ELTU and Department of Physical Sciences, respectively. FDN (Foundation) courses do not carry credits for the final GPA calculation.

First Year			
Course Code	**Course Title**	**Lecturers In Charge**	**Status**
BOT 1201	Plant Diversity	**PLH** SH, AW	C
BOT 1202	Functional Plant Anatomy and basic Wood Science	**PLH** AW	C
BOT 1203	General Microbiology	**PNY** SH	C
Botany 06 (06 C and 00 O) Credits			
ZOO 1201	Invertebrate Diversity	**KU, SW DKH**	C
ZOO 1303	Vertebrate Diversity	**KU, SW, TVS, RV**	C
ZOO 1104	Laboratory Techniques in Zoology	**RJ** MW	O
Zoology 06 (05 C + 01 O) Credits			
BIO 1201	Cell Biology & Biochemistry	**KU** GDA	C
BIO 1202	Statistical Methods in Biology	**RV** RD	C

Biology 04 (04 C) Credits **N.B.** When Botany (BOT) and Zoology (ZOO) are offered as subjects, Biology (BIO) Course credits contribute equally to each subject.			
IDC 1201	Philosophy of Science	**SH** KV	C
Int. Dis. Courses 02 (02 C + 00 O) Credits			
FDN 1204	Basic Mathematics	MM CP	C
First Year Total Credits – 18 (17 C + 01 O) (Botany 06(06) + Zoology 06(05) + Biology 04(04)) +IDC 02(02)			
Second Year			
Course Code	**Course Title**	**Lecturers In Charge**	**Status**
BOT 2201	Plant Physiology	**AW** PNY	C
BOT 2202	Plant Pathology	**GDA** TCB	C
BOT 2203	Flora of Sri Lanka	**AW** PLH	O
Botany 08 (04 C and 04 O) Credits			
ZOO 2201	Animal Histology and Physiology	**MMG** KU	C
ZOO 2202	General Entomology	**RJ** DKH, MW	C
ZOO 2203	Animal Behaviour	**RV**,SW KU	C
ZOO 2204	Fish Biology	**TVS**	O
Zoology 08 (04 C and 04 O) Credits			
BIO 2201	Systematic Biology	**KU, AW** PLH	C
BIO 2302	Principles of Ecology	**SW** RV	C
BIO 2203	Genetics and Evolution	**KU** RV	C
Biology 07 (07 C and 00 O) Credits **N.B.** When Botany (BOT) and Zoology (ZOO) are offered together as subjects, Biology (BIO) Course credits contribute equally to each subject.			
IDC 2201	English for Professional purposes		O
IDC 2202	Scientific Communication	**RV** TCB	C
IDC 2203	Principles and Practices of Marketing		O

Int. Dis. Courses 6 (02 C and 04 O) Credits			
Second Year Total Credits- 27 (21 C + 06 O) (Botany 08(04) + Zoology 08(04) + Biology 07(07) + IDC 04(02)			
Third Year			
Course Code	**Course Title**	**Lecturers In Charge**	**Status**
BOT 3201	Plant Tissue Culture	**PLH** TCB	O
BOT 3202	Principles and Practice of Horticulture and Landscaping	**PLH** AW	O
BOT 3203	Postharvest Technology of Plant Products	**PNY** SH	O
BOT 3204	Economic Botany	**AW** PLH	C
BOT 06 (00 C + 06 O) credits			
ZOO 3201	Medical Entomology	**RJ** MGA	O
ZOO 3202	Applied Parasitology	**RJ** DKH	O
ZOO 3203	Economic Entomology	**PMW** RJ	O
ZOO 3204	Embryology and Developmental Biology	**EPS** NW	C
ZOO 08 (02 C + 06 O) credits			
BIO 3201	Molecular Biology	**TCB** SH, GDA	C
BIO 3102	Ecotourism	**SW** RV	O
BIO 3203	Environmental Pollution	**SW** PNY	O
BIO 3204	Bioinformatics	**GDA** TCB, KU	O
BIO 3205	Ecotoxicology	LPJ MS	O
BIO 3206	Experimental Design and Nonparametric Methods in Statistics	**RV** RD	O
BIO 3207	Field Project in Biology		O
BIO 16 (05 C + 11 O) credits			
BDC 3301	Concepts of Biodiversity Conservation	**RJ** SW	O
BDC 3202	Environmental Impact and Risk Assessment	**SW**	O
BDC 3203	Introduction to GIS	SW SY	O
BDC 3204	Wildlife Management and Conservation	**SW** RV	O
BDC 09 (00 C + 09 O)			

FAM 3201	Fisheries and Aquaculture	**TVS** NJS	O
FAM 3302	Breeding Techniques in Aquaculture	**TVS** NJS	O
FAM 3303	Ornamental Fishery	**TVS**	O
FAM 08 (00 C + 08 O) credits			
MIB 3201	Industrial Microbiology	**PNY** TCB	O
MIB 3202	Soil Microbiology	SH PNY	O
MIB 3203	Virology	**SH** TCB	O
MIB 3204	Food Microbiology	**PNY** SH	O
MIB 3205	Plant-Microbe Interactions	**PNY,** TCB, SH	O
MIB 10 (00 C + 10 O) credits			
IDC 3201	Entrepreneurship Development		O
IDC 3202	Standards and Quality Management Systems	**NSP** **SCW**	O
IDC 04 (00 C + 04 O)			
N.B. When Botany (BOT) and Zoology (ZOO) are offered together as subjects, FAM courses shall be considered in Zoology and MIB courses in Botany, and contribution to each subject by BIO courses and BDC courses is 50% of the total.			
Third Year Total Credits- 61 (07 C + 54 O) BOT 06(00)+ZOO 08(02)+BIO 16(05)+BDC 09(00)+FAM 08(00)+MIB 10(00)+IDC 04 (00)			
First Year Total Credits – 18 (17 C + 01 O) (Botany 06(06) + Zoology 06(05) + Biology 04(04)) +IDC 02(02) Second Year Total Credits- 27 (17 C + 10 O) (Botany 08(04) + Zoology 08(04) + Biology 07(07) + IDC 04(02) Third Year Total Credits- 61 (07 C + 54 O) BOT 06(00)+ZOO 08(02)+BIO 16(05)+BDC 09(00)+FAM 08(00)+MIB 10(00)+IDC 04 (00)			
Total Credits - 106 (41 C+65 O) -BOT 20(10+10), ZOO 22(11+11), BIO 27 (16+11), BDC 09 (00+09), FAM 08 (00+08), MIB 10 (00+10), IDC 10 (04+06)			

4. **LIST OF COURSES OFFERED BY THE DEPARTMENT OF BIOLOGICAL SCIENCES FOR B. SC. HONOURS DEGREE PROGRAMES**

Specialization Area			Biodiversity Conservation		Fisheries and Aquaculture Management		Microbiology	
Course unit		Lecturers	Status	Credits	Status	Credits	Status	Credits
Third Year								
BOT 3201	Plant Tissue Culture	**PLH** TCB	C	02 C	C	02 C 02 O	O	02 C 02 O
BOT 3202	Principles and Practice of Horticulture and Landscaping	**PLH** AW			O			
BOT 3203	Postharvest Technology of Plant Products	**PNY** SH					C	
ZOO 3201	Medical Entomology	**RJ** MGA	C	06 C 02 O		04 C 02 O		02 O
ZOO 3202	Applied Parasitology	**RJ** DKH	O		C		O	
ZOO 3203	Economic Entomology	**TVS** NJS	C		O			
ZOO 3204	Embryology and Developmental Biology	**EPS** MGA	C		C			
BIO 3201	Molecular Biology	**TCB** SH, GDA	C	09 C 02 O	C	10 C 01 O	C	10 C
BIO 3102	Ecotourism	**SW** RV	C		O			
BIO 3203	Environmental Pollution	**SW** PNY	C		C		C	
BIO 3204	Bioinformatics	**GD** TCB KU	O		C		C	
BIO 3205	Ecotoxicology	LPJ MS	C		C		C	
BIO 3206	Experimental Design and Nonparametric Methods in Statistics	**RV** RD	C		C		C	
BIO 3207	Field Project in Biology	**SW** AW RV	C					
BDC 3301	Concepts of Biodiversity Conservation	**RJ** SW	C	09 C	O	04 C 05 O	O	04 O
BDC 3202	Environmental Impact and Risk Assessment	**SW**	C		C			
BDC 3203	Introduction to GIS	SW SY	C		C		O	

BDC 3204	Wildlife Management and Conservation	**SW** RV	C		O			
FAM 3201	Fisheries and Aquaculture	**TVS** NJS			C			
FAM 3302	Breeding Techniques in Aquaculture	**TVS** NJS			C	08 C		
FAM 3303	Ornamental Fishery	**TVS**			C			
MIB 3201	Industrial Microbiology	**PNY** TCB					C	
MIB 3202	Soil Microbiology	**SH** PNY					C	
MIB 3203	Virology	**SH** TCB					C	
MIB 3204	Food Microbiology	**PN Y** SH			C		C	
MIB 3205	Plant-Microbe Interactions	**TCB** PNY SH				02 C	C	16 C
MIB 3206	Analytical Techniques in Biology	**SH** PLH					C	
MIB 3207	Immunology	T**CB** GDA					C	
MIB 3208	Environmental Microbiology	**SH** PNY					C	
IDC 3201	Entrepreneurship Development		O		O		O	
IDC 3202	Standards and Quality Management Systems	**NSP** SC W	O	04 O	O	04 O	O	04 O
Fourth Year Courses								
BDC 4201	Environmental Policies and Management	**SW** RV	C					
BDC 4202	Wetland Conservation and Management	**SW** RV	C					
BDC 4203	Forest Conservation	**AW** WS	C					
BDC 4204	Advanced Geographical Information Systems	**SW** RV	C					
BDC 4205	Economics of Biodiversity	**SW**	C	26 C				
BDC 4206	Aquatic Resources & Conservation	**TVS** PAC	C					
BDC 4207	Coastal and Marine Biodiversity Conservation	SW	C					
BDC 4208	Current Topics in Biodiversity Conservation		C					
BDC 4209	In plant Training		C					

BDC 4810	Research Project		C					
FAM 4201	Fishery Resources Management	**TVS** PH AG			C	26 C		
FAM 4202	Aquaculture engineering	**TVS**			C			
FAM 4203	Aquafarming of Macrophytes	**PLH** AW			C			
FAM 4204	Fish nutrition and Growth				C			
FAM 4205	Fish health Management				C			
FAM 4206	Postharvest Techniques in fisheries				C			
FAM 4207	Fishery Economics				C			
FAM 4208	Current Topics in Fisheries and Aqua. Manag.				C			
FAM 4209	In plant Training				C			
FAM 4810	Research Project				C			
MIB 4201	Applied Mycology	**PNY** GDA					C	25 C
MIB 4202	Medical Microbiology	**TCB** JD					C	
MIB 4103	Molecular Microbiology	**TCB** GDA					C	
MIB 4204	Microbial Taxonomy	**SH** GDA					C	
MIB 4205	Techniques and Strategies in Molecular Biology	**TCB** SH					C	
MIB 4206	Molecular Biotechnology	**TCB** GDA					C	
MIB 4207	Microbial Genetics	**TCB** SH					C	
MIB 4208	Current Topics in Microbiology						C	
MIB 4209	In plant Training						C	
MIB 4810	Research Project						C	

Prerequisites:

Biodiv. Conserv: BOT 1201 Plant Diversity, BOT 1203 General Microbiology, ZOO 1201 Invertebrate Diversity, ZOO 1303 Vertebrate Diversity, BIO 1201 Cell Biology & Biochemistry, BIO 1202 Statistical Methods in Biology, BOT 2201 Plant Physiology, BOT 2203 Flora of Sri Lanka, ZOO 2201 Animal Histology and Physiology, ZOO 2202 General Entomology, ZOO 2203 Animal Behaviour, ZOO 2204 Fish Biology, BIO 2201 Systematic Biology, BIO 2302 Principles of Ecology, BIO 2203 Genetics and Evolution, IDC 2202 Scientific Communication (34 credits)

For Fish. and Aqua. Manage: BOT 1201 Plant Diversity, BOT 1203 General Microbiology, ZOO 1201 Invertebrate Diversity, ZOO 1303 Vertebrate Diversity, BIO 1201 Cell Biology &

Biochemistry, BIO 1202 Statistical Methods in Biology, ZOO 2201 Animal Histology and Physiology, ZOO 2204 Fish Biology, BIO 2201 Systematic Biology, BIO 2302 Principles of Ecology, BIO 2203 Genetics and Evolution, IDC 2202 Scientific Communication (26 credits) **For Microbiology:** BOT 1201 Plant Diversity, BOT 1203 General Microbiology, BIO 1201 Cell Biology & Biochemistry, BIO 1202 Statistical Methods in Biology, BOT 2201 Plant Physiology, BOT 2202 Plant Pathology, BIO 2201 Systematic Biology, BIO 2302 Principles of Ecology, BIO 2203 Genetics and Evolution, IDC 2202 Scientific Communication, CHE 1201 General and Inorganic Chemistry, CHE 1203 Organic Chemistry I, CHE 2202 Organic Chemistry II, CHE 2105 Inorganic Chemistry II, (28 credits)					
Total Compulsory Credits (Year 3 and Year 4)	52		56		53
Credits from subject area (Year 1 and Year 2)	34		26		28
Total Compulsory Credits from field of specialization	86		82		81
Min. other Credits from Year 1 and Year 2 (Min. 26 Credits per Year)	18		26		25
Max. credits required for 120 Credits	16		12		14

5. DETAILES OF COURSES OFFERED FOR BIOLOGICAL SCIENCES STUDY PROGRAMMES

N.B. Following the SLQF guidelines, volume of learning is set as 50 notional hours per one credit. Following list of courses indicates 40 notional hours per credit, the actual number is 50 hours, when 10 hours allocated for preparation for assessments is accounted for.

First Year

Course Name: Plant Diversity

Course Code: BOT 1201 (Theory 22 hrs, Pract. 20 hrs + Field 11 hrs, IL 27 hrs)

Course Capsule: Historical development of biological classification, Key events of plant evolution, Characteristics of major taxonomic groups in kingdoms Fungi, Protista (only algae) and Plantae (excluding Anthophytes), Economic and ecological importance of fungi, algae, bryophytes, pteridophytes and gymnosperms, Habitat preference and evolutionary affinities in and among fungi, algae, bryophytes, pteridophytes and gymnosperms, Introduction to lichens- an alliance between kingdoms

Course Aim: To familiarize major categories of fungi, algae, bryophytes, pteridophytes , gymnosperms and lichens that students come across in the surrounding, to acquire the ability to identify them in the field, view their role as ancestors to angiosperms and to learn to appreciate them as "useful creatures" on earth**.**

Course ILOs: At the end of the course, students should be able to

1. discuss how the modern systems of Biological Classification were developed
2. explain why brown algae and diatoms are placed with water molds and downy mildews in a special group known as Heterokonta (Stramenophila)
3 discuss the importance of key events in plant evolution
4. describe the vegetative and reproductive diversity in major taxonomic groups of fungi, algae and plants excluding angiosperm
5. recognize, identify and comment from where to collect them and to explain the reasons forvarious taxonomic groups to occupy different habitats
6. explain the evolutionary affinities in and among fungi, algae, bryophytes, pteridophytes and gymnosperms
7. explain how fungi, algae, plants and lichens become important to man
8. design and carry out collection and identification of common algae, bryophytes, pteridophytes , gymnosperms and lichens.

Resource Requirements: Handouts, Multimedia, computers, live specimens, laboratories, lecture theatres, greenhouse/planthouse, Botanic Garden and access to few localities with a high diversity of lower plants.

Transport Requirements: Vehicle (bus and a van) to take students to

1. National Botanic Gardens, Peradeniya and Kadugannawa (one day field class)

2. Sallimundal - Pasikuda (one day field class for algae)

Assessment Strategy:

Continuous assessment		-30%
Mid- semester examination	-10%	
Herbarium and reports	- 20%	
End semester assessment		-70%
Written paper (theory)	- 50%	
Practical exam	- 20%	

References:

1. B Goffinet and AJ Shaw (2009) Bryophyte Biology, Cambridge University Press, New York. (PDF available)
2. J Webster and R Weber (2007) Introduction to Fungi, Cambridge University Press
3. PC Vasishta (2000). Botany, Part IV- Pteridophyta, S. Chand and Company Ltd, New Delhi.
4. PC Vasishta (2004) Botany for Degree Students, Part III- Bryophyta, S. Chand and Company Ltd., New Delhi.
5. BR Vashishta (2004) Botany for Degree Students, Part V- Gymnosperms, S. Chand and Company Ltd., New Delhi.
6. CJ Alexopoulos, CW Mims and M Meredith (1995) Introductory Mycology, 4th Edition, Blackwell
7. BP Pandey (1993) Pteridophyta, S. Chand and Company Ltd, New Delhi
8. E Coppejans, F Leliaert, O Dargent, R Gunasekara and O de Clerck (2009) Sri Lankan Seaweeds: Methodologies and field guide to the dominant species, Vol 6, Abc Taxa.

Teaching Panel: Prof. Sanath Hettiarachi (e mail:sanath.hetti@gmail.com; Tel: 0771101501))

Dr. (Mrs.) P.L. Hettiarachchi (email: phlakshmi@yahoo.com; Tel: 0771238980)

Course Coordinator: Dr. (Mrs.) P.L. Hettiarachchi

Course Name: Functional Plant Anatomy and Basic Wood Science

Course Code: BOT 1202(Theory 23 hrs, Pract. 21 hrs + field 03hrs, IL 33 hrs)

Course Capsule: Introduction; Organization of plant body; Types of meristematic tissues, based on origin and development, position and function; structure, diversity in cell types, cell contents, cell wall deposits and appendages **in relation to functions** in permanent plant cells, simple and complex tissues; Primary structure and secondary growth of typical stem and root **in relation to functions**. Anatomy of typical dicot, monocot leaves and circular leaf **in relation to functions; Anomalous secondary growth in plant** stems and roots; **Ecological Plant Anatomy:** variation in structure, related to habitat.

Wood: Macroscopic and microscopic structure of wood, wood chemistry and wood quality, relationship between wood anatomy, its physical properties and technical performance of timber, microscopic and macroscopic characters used in the identification of timber with special reference to local species, Defects of wood, Grading of timber, Common and specific uses of wood (IL), wood seasoning, wood preservation, wood based industries in Sri Lanka.

Course Aim: To determine the importance of plant architecture to its survival and functions, to learn its importance to man, to be appreciative in application of internal organization of cells and tissues in timber selection and identification, and also in identification of raw plant material used in industries, to provide basic knowledge regarding wood seasoning, wood preservation and wood based industries in Sri Lanka.

Course ILOs: At the end of the course the student should be able to

1. explain the organization and functions of plant tissues and organs and their uses to man
2. explain how morphological and anatomical features are related to habitat and functions of the plant
3. distinguish anomalous growth from typical growth in stems and roots
4. identify the characteristic features of economically important timber species
5. estimate the technical value of a given sample of timber
6. utilize the knowledge gained in the class to select timber and wood items and to preserve wood in actual situations in life
7. utilize anatomical features to identity plants and plant material used in industries

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres, fresh and preserved plant material

Transport Requirements: A bus to visit a timber factory

Assessment Strategy:

Continuous assessment		-30%
Mid- semester	-10%	
Assignments	-15%	
Quizzes	-05%	
End semester Examination		-70%
Theory	-50%	
Practical	-20%	

References:

1. SN Pandey and AV Chadha (2001) Plant Anatomy and Embryology, Vikas Publishing House PVT LTD, New Delhi.
2. A Fahn (1997) Plant Anatomy 4th ed. Aditya Books (Pvt.) Ltd., New Delhi.
3. BP Pandey (1997) Plant Anatomy. S. Chand and company LTD, New Delhi.
4. SN Pandey and A Chadha (1993) A Textbook of botany: plant anatomy and economic botany, Vol. III. Vikas Publishing House PVT LTD, New Delhi.
5. HA Core and WA Cote (1979) Wood Structure and Identification 2nd ed. Syracuse Univ Press
6. FFP Kollmann and WA Cote (1968)Principles of wood science and technology, Springer
7. CR Metcalf and L Chalk (1979) Anatomy of the Dicotyledons Vol I, Oxford Science Publications.
8. PB Tomlinson and CR Metcalf (1982) Anatomy of the Monocotyledons Vol 7, Clarendon Press.
9. K Esau (1977) Anatomy of Seed Plants 2nd ed. Wiley.
10. RFE Vert and SE Eichhorn (2006) Esau's Plant Anatomy 3rd ed. John Wiley and Sons, New Jersey.

Teaching Panel:

Dr. (Mrs.) Priyani L. Hettiarachchi (email: phlakshmi@yahoo.com, Tel: 0771238980)
Dr. W.M.G. Asanga S.T.B. Wijetunga (email: astbw@yahoo.com, Tel: 0777610876)

Course Coordinator: Dr. (Mrs.) Priyani L. Hettiarachchi

Course Name: General Microbiology
Course Code: BOT 1203 (Theory 24 hrs, Pract. 18 hrs, IL 38 hrs)

Course Capsule: The microbial world and you, history of microbiology, Microbial naming and classification, microscopy, Bacterial cell structure and functions, Bacterial identification using their morphological characteristics, Nutrition and metabolism of microorganisms, Microbial growth, Microbial interactions, Ecological and economic importance of microorganisms; Plant growth promoting rhizobacteria, Structure and reproduction of blue green bacteria and actinomycetes, Mycoplasma, Introduction to viruses, viroids and prions, General structural characteristics of viruses, lytic and lysogenic cycles, Disease mechanisms, Host/pathogen relationships, virus and cancer, Microbes used in biotechnology, Antibiotic producing microorganisms, Control of microbial growth, Action mechanisms of antibacterial and antifungal antibiotics, Microbial biofilm formation.

Course Aim: to teach the fundamental concepts regarding structure and metabolism of microorganisms along with the main phylogenetic and physiological relations among them in natural habitat and their biotechnological applications. The laboratory component will equip students with hands-on experience in microbiology techniques and diagnostic procedures.

Course ILOs: At the end of the course, the student should be able to

1. characterize the microorganisms into different domains in terms of cellular anatomy and physiology (archaea/ bacteria/ eubacteria)
2. distinguish cell envelope structures in Gram positive , Gram negative and acid fast bacteria
3. summarize the properties of microorganisms in terms of biochemistry and genetics and correlate these concepts to applications in biotechnology
4. explain the effect of oxygen on microbial growth and adaptations that have occurred in psychrophiles/ thermophiles/ halophiles
5. demonstrate proper microbiology laboratory techniques involving microscopy, biochemical tests and diagnostic media to characterize microorganisms
6. describe the diversity of microorganisms and their metabolic capabilities to produce an extensive array of products in agriculture, industry and medicine
7. compare and contrast commensal, symbiotic, and pathogenic relationships
8. discuss the main characteristics of microbes that might be present in a given ecosystem
9. describe basic concepts associated with the virus structure and replication
10. describe disease mechanisms and pathogen host interactions
11. evaluate the physical and chemical means used to control microbial growth and contamination
12. compare and contrast cell structure and function in a biofilm with pelagic cells

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Assessment Strategy:

Continuous assessment		-40%
Presentations	-10%	
Group discussions	-10%	
Practical skills/lab report evaluation	-10%	
Class test (theory)	-10%	
End semester examination		-60%
Practical	`-20%	
Theory	-40%	

References:

1. JM Willey, LM Sherwood and CJ Woolverton (2011). Prescott's Microbiology, 8th ed. McGraw- Hill.
2. GJ Tortora, Christine L and Funke BR (2007). Microbiology: an introduction, 9th ed. Pearson Education, New Delhi.

Teaching Panel: Mrs. P. Neelamani Yapa (pnyapa40@yahoo.co.uk)

Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 0771101501)

Course Coordinator: P. Neelamani Yapa

Course Name: Invertebrate Diversity

Course Code: **ZOO 1201** (Theory 24 hrs, Pract. 18 hrs IL 38 hrs)

Course Capsule: Animal body plans, Diversity of major invertebrate phyla: Protozoan groups and Phyla Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda, Mollusca, Annelida, Onychophora, Arthropods, minor invertebrate phyla, Echinodermata.

Course Aim: To provide a basic understanding of the diversity of major invertebrate phyla in the world and how their body plans have changed with evolutionary advancement, and to develop the ability of the student to identify the phylum and class of any given invertebrate.

Course ILOs: At the end of the course, the students should be able to

1. identify different body plans of animals
2. describe how body plans change with evolutionary advancement in different invertebrate phyla
3. define the key features of major invertebrate phyla
4. identify the phylum and the class of any given invertebrate

Resource Requirements: Handouts, multimedia projector, computers, laboratories, lecture theatres

Transport Requirements: A vehicle will be required to take the students on a single field trip to the Uppaveli beach, Trincomalee to observe marine invertebrates.

Assessment Strategy:

Continuous assessment:		-35%
Assignments	-10%	
Practical records	-05%	
Mid-semester	-20%	
End semester assessment		-65%
Theory	- 50%	
Practical	-15%	

References:

1. P Raven, G Johnson, K Mason, J Losos and S Singer (2013) Biology. 10th ed. McGraw-Hill,
2. EE Ruppert and RS Fox (2004) Invertebrate zoology: a functional evolutionary approach. Brooks/Cole, Belmont, CA.
3. CP Hickman, LS Roberts and A Larson (2001) Integrated principles of Zoology. McGraw-Hill, Boston.

Teaching Panel: Dr. Kanishka Ukuwela (email: kanishkauku@gmail.com)
Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com)

Course Coordinator: Dr. Kanishka Ukuwela

Course Name: **Vertebrate Diversity**

Course Code: **ZOO 1303** (Theory 28 hrs, Pract. 45 hrs, IL- 47 hrs)

Course Capsule: Chordate Body plan, Major features of Phylum Chordata, Diversity of major Vertebrate classes: Jawless fish, Jawed fish, Amphibia, Reptilia, Aves, Mammalia

Course Aim: To provide a basic understanding of the defining features of vertebrates, diversity of major vertebrate classes in the world and how their body plans have changed with evolutionary advancement, and to develop the ability of the student to identify the class and order of any given vertebrate.

Course ILOs: At the end of the course, the students should be able to

1. define the key features of vertebrates
2. state the key defining characteristics of all the major vertebrate classes
3. compare and contrast body plans and organ systems between different invertebrate groups view with of elucidating broad evolutionary trajectories
4. place any given organisms into their respective classes and the orders based morphological features of the vertebrate
5. critically examine the key adaptations of vertebrate species to their respective ecological niches

Resource Requirements: Handouts, multimedia projector, computers, laboratories, lecture theatres, Videos (BBC Wildlife –Life in cold blood, Life of Mammals)

Transport Requirements: A bus will be required to take the students on a single field trip to the Zoological gardens to observe the diversity of vertebrates.

Assessment Strategy:

Continuous assessment		-40%
Assignments	-10%	
Practical records	-10%	
Mid-semester	-20%	
End semester examination		-60%
Theory	-40%	
Practical	-20%	

References:

1. CP Hickman, LS Roberts and A Larson (2010) Integrated principles of Zoology. McGraw-Hill, Boston.
2. LJ Vitt, JP Caldwell (2013) Herpetology: An Introductory Biology of Amphibians and Reptiles. Academic Press, San Diego, USA.
3. G Scott (2010) Essential Ornithology. Oxford University Press. Oxford.UK.
4. P Raven, G Johnson, K Mason, J Losos and S Singer (2013) Biology. 10th ed. McGraw-Hill, Boston.

Teaching Panel: Dr. T.V. Sundarabarathy (email: tvbarathy@gmail.com)
Dr. Kanishka D.B. Ukuwela (email: kanishkauku@gmail.com)
Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com)
Dr. R.P.G. Vandercone (email: vandercone@gmail.com)

Course Coordinator: Dr. Kanishka D.B. Ukuwela

Course Name: Laboratory technique in Zoology

Course Code: ZOO 1104 (Theory 05, Pract. 30 hrs, IL 05 hrs)

Course Capsule: Safety in a biological laboratory, Preparation of widely used chemical reagents, Microscopy (structure and function, cleaning and servicing), Microtome, Preparation of temporary & permanent slides of Parasitological and Histological specimens using single and double staining methods, Taxidermy (mainly mammals, birds and fishes), Preparation of permanent mounts of insects, Preparation & mounting of skeletons, Embedding biological specimens in liquid plastic, Field techniques for zoological specimen collection and preservation.

Course Aim: To provide theoretical and practical knowledge needed with respect to safety and laboratory discipline, Proper use of laboratory equipment, to equip students with the knowledge and experience in taxidermy, preparing specimens and slides for research and museums, to get them exposed to techniques used in the field when collecting biological specimens for preservation.

Course ILOs: At the end of the course, students should be able to

1. use and maintain laboratory environment , discipline and equipment in proper way
2. prepare regents relevant to the course
3. prepare temporary and permanent slides and mounts of zoological specimens
4. prepare zoological specimens following taxidermy

Resource Requirements: Handouts, laboratories, chemicals, zoological material

Assessment Strategy:

Continuous assessment of class work	-40%
End semester practical examination	-60%

References:

1. G Rolls (2011) An Introduction to Specimen Preparation**.** Leica Biosystems, Melbourne.
2. A Turner (2013) Taxidermy. Thames and Hudson Publishers, UK.

Teaching Panel: Mr. Mahinda Samarakoon
Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Coordinator: Mr. Ravindra Jayaratne

Course Name: Cell Biology and Biochemistry

Course Code: BIO 1201 (Theory 24 hrs, Pract. 10 hrs IL 46 hrs)

Course Capsule: Biomolecules and Molecular Organization: Inorganic ions, Carbohydrates, Lipids, Proteins, Nucleic acids, Identification of Biomolecules, DNA Replication, Transcription and translation of genetic information; Cytology: Cell ultra- structure, Cell Division; Biological membranes: Structure and functions; Enzymes: General properties and mechanism of action; Enzyme kinetics, Bioenergetics.

Course Aim: To develop and enhance the understanding of student in biomolecules and their organization in life, to improve the ability of the student to identify the components of cell ultrastructure and cellular organelles and describe their functions, to foster the understanding of students on biological membranes and the general properties of enzymes and their functional mechanism

Course ILOs: At the end of the course, the students should be able to

1. describe the structure and function of biological molecules that are important for life and identify these biomolecules using diagnostic tests
2. describe the cell ultrastructure and the structure and functions of cellular organelles and identify the key components of the cells
3. compare and contrast the steps in mitotic and meiotic cell division
4. explain the structure and functions of biological membranes
5. explain the basic mechanisms behind cell signaling
6. explain the basic concepts behind the transformation of energy in living organisms
7. relate the general properties of enzymes and their functional mechanism

Resource Requirements: Handouts (Practicals), multimedia projector, computers, laboratories, lecture theatres

Transport Requirements: None

Assessment Strategy:

Continuous assessment		-35%
	Assignments	-10%
	Practical records	-05%
	Mid-semester assessment	-20%
End semester examination		-65%
	Theory	-50%
	Practical	-15%

References:

1. PG Raven, G Johnson, K Mason, J Losos and S Singer (2013) Biology. 10thed. McGraw Hill, Boston.
2. H Lodish, A Berk, S L Zipursky, P Matsudaira, D Baltimore, and J Darnell (2003) Molecular Cell Biology. 5thed. W.H. Freeman and Company, NY

Teaching Panel: Dr. Kanishka Ukuwela (email: kanishkauku@gmail.com)
Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com)

Course Coordinator: Dr. Kanishka Ukuwela

Course Name: Statistical Methods in Biology

Course Code: **BIO 1202** (Theory 25 hrs, Pract. 10 hrs, Tutorials 10 hrs, IL hrs 35)

Course Capsule: Introduction to the scope and nature of statistics, Data collection and visual representation of data, Measures of position and dispersion, Normal distribution and its applications, Confidence intervals, Concept of hypothesis testing (single sample mean and proportion, two sample mean and proportion), Chi square test of independence and goodness of fit, Scatter plots and correlation, Least squares regression, Use of statistical software.

Course Aim: To develop an innate interest in statistical thinking (ST) in students, instill the belief that statistics is an important part of the scientific research process and a valuable transferable skill (SRTS) and provide students with the theoretical and practical foundation and instill initiative (IN), responsiveness (RS) and leadership (LE) so that they can employ and build on in flexible ways through a process of lifelong learning (LL).

Course ILOs: At the end of the course, students should be able to

1. differentiate between different types of data
2. select appropriate sampling methods for data collection
3. use appropriate graphical methods to display data
4. utilize descriptive statistics to describe a dataset
5. identify the properties of a normal distribution and calculate chances and percentages using a normal curve
6. calculate and interpret confidence intervals for a mean and proportion
7. state null and alternative hypothesis and carryout one and two sample hypothesis tests involving means and proportions
8. identify the relationship between *p* values and confidence intervals

9. perform a chi-square test of goodness-of- fit and association
10. carryout a correlation test to determine the relationship between two numerical or quantitative variables
11. identify the underlying assumptions of a least squares regression and carryout least squares regression test
12. use statistical software to carryout basic statistical operations such as data exploration and description, graphical representation of data, t-test, chi-square test, correlation test, least squares regression

Resource Requirements: a sufficient number of computers with statistical software

Transport Requirements: Not required

Assessment Strategy:

Continuous assessment (CA)		-30%
Tutorials	-10%	
Mid semester assessment	-20%	
End semester examination		-70%
Theory	-50%	
Practiclas	-20%	

References:

1. RR Sokal and FJ Rohlf (2011) Biometry. W. H. Freeman NY
2. HJ Zar (2009) Biostatistical Analysis. New Jersey, Pearson.
3. A Agresti and B Finlay (2008) Statistical Methods for the Social Sciences. New Jersey, Pearson.

Teaching Panel: Dr. Rajnish P. Vandercone (email: vandercone@gmail.com)
Mr. Ranjan Dissanayake

Course Coordinator: Dr. Rajnish P. Vandercone

Course Name: Philosophy for Science

Course Code: IDC 1201 (Theory 30 hrs, IL 50 hrs)

Course Capsule: The aims and objectives of philosophy (nature, scope and importance of studying philosophy), Historical development of philosophical thought, Problems related to Theory of Knowledge (problems of reception, knowledge & belief, theories of truth), Analysis of Metaphysical problems (nature of metaphysical problems, validity of metaphysical concepts in human life), Analysis of ethical issues (Importance of ethics in social behavior), Analysis of the problem of Inductive Knowledge (nature of deductive and inductive logic, nature of scientific method: formation of hypothesis, verification, prediction and probability),Philosophical analysis of the reliability of scientific knowledge. Can fundamental philosophical questions to be answered by the science? , The limitations of empirical knowledge

Course Aim: With the successful completion of this course unit, students will be able to understand the nature of philosophy, its historical development and its contribution in the development of science, the nature of philosophical problems and the analysis of

philosophical problems and their effectiveness in human behavior. It is also provided an understanding of the limitations of empirical knowledge based on sense experience.

Course ILOs: At the end of this course, students should be able to

1. relate the nature of philosophy to science
2. discuss the historical development and its contribution in the development of science
3. explain the nature of philosophical problems
4. analyze philosophical problems and their effectiveness in human behavior
5. discuss the limitations of empirical knowledge based on sense experience

Resource Requirements: Handouts, Multimedia, computers, lecture theatres,

Transport Requirements: No transport requires

Assessment Strategy:

Continuous assessment		-50%
Tutorial	-10%	
Oral presentation	-10%	
Assignment	-20%	
End semester Exam		-60%

References:

1. B Russell (1967) History of Western Philosophy, Simon & Schuster/Touchstone
2. B Russell(2009)The Problems of Philosophy, Wilder Publications
3. AJ Ayer (1952) Language Truth and Logic, 2nd ed. Dover Publications
4. M Williams (2001)Problems of Knowledge: A Critical Introduction to Epistemology, Oxford University Press

Teaching Panel: Prof. V.G. Upasena (email: profvgk@kln.ac.lk)

Course Coordinator: Prof. Sanath Hettiarachi

Course Name: Basic Mathematics

Course Code: **FDN 1204** (Theory 30 hrs, Tutorials 15 hrs, IL 35 hrs)

Course Capsule: Instantaneous Velocity and the Derivative, Differentiation Rules, Sines, Cosines, and their Derivatives, Maxima and Minima, Maxima-Minima Real-World Problems, Exponentials and Logarithms, Exponential Growth and Decay, The Second Derivative and Curve Sketching, Antidifferentiation, Differentiability and Continuity, The Integral, Area and the Riemann Integral, The Fundamental Theorem of Calculus, Properties of the Definite Integral, Indefinite Integrals, Integration by Substitution, Trigonometric Functions and Their Inverses, Integration by Table, Partial Fractions and Integration by Parts, Differential Equations, Linear Second Order Homogeneous Constant-Coefficient

Course Aim: This course is a one-semester survey of calculus primarily for students in the biological or life sciences. It includes a non-theoretical treatment of differential and integral calculus and a brief introduction to differential equations, with applications to the life sciences.

Course ILOs: At the end of the course, the student should be able to

1. describe the development of Real and Complex number systems
2. work with basic functions: linear, polynomial, exponential, logarithmic and trigonometric
3. compute first and second derivatives of a large class of functions and apply. differentiation techniques to the solution of simple problems in the social and biological sciences
4. find optimal solutions to problems in the social and biological sciences, using the theory of maxima and minima
5. solve applied problems, using the properties of exponential and logarithmic functions
6. find the indefinite and definite integrals for a variety of functions and find the area under a curve and between two curves.
7. solve integration problems using basic techniques of integration, including integration by parts and partial fractions
8. solve first and second-order differential equations using analytical and graphical methods as appropriate

Resource Requirements: Handouts, Multimedia, computers with internet, lecture theatres

Transport Requirements: No

Assessment Strategy:

Continuous assessment		-40%
Homework	-20%,	
Mid- semester class test	-20%	
End semester assessment		-60 %

References:

1. F Morgan and AK Peters (1995) Calculus Lite 3rd ed. Wellesley, Massachusetts (Required)

Teaching Panel: Mr. M.A.M. Mohomad (email: misaj_2005@yahoo.co.uk)
Prof. Upali Mampitiya (Email: upali.mampitiya@gmail.com)

Course Coordinator: Prof. Sanath Hettiarachi

Second Year

Course Name: Plant Physiology

Course Code: BOT 2201 (Theory 25 hrs, Pract. 15 hrs, IL 40 hrs)

Course Capsule: Soil plant atmosphere continuum, leaf and root hydraulic conductivity, components of water potential- solute potential, turgor potential, matric potential, measuring water Potential, challenges in ecohydrolgy and plant–water relations, mechanisms of stomatal movements, essential mineral nutrients, mechanisms of nutrient absorption, potassium channels, Calmodulin- signal transducer, ATP binding cassette *(*ABC*)* transporters, photosynthesis – mechanism and regulation of photosynthesis, choloroplasts, chlorophylls, light dependant reactions, photorespiration, C3, C4 and CAM pathways, Source sink relationship, Subcellular transport of metabolites, Oxidative phosphorylation and electron transport chain mechanisms, Proton pumping, Inhibitors of ATP synthesis, Energetics of the TCA cycle and glucose oxidation,Plant growth regulators and movements, Signal perception andtransduction, Phytochromes and phytotrophic Signal transductions, Photomorphogenesis, Physiology of growth and development, Circadian rhythms, Physiology of flowering, vernalisation, mechanism and regulation of seed dormancy and germination, Seed viability and biophysical basis of seed longevity, Leaf senescence, Fruit ripening, Bud dormancy, Programmed cell death, Structure, occurrence and biosynthesis of the plant secondary metabolites, Allelochemicals and allelopathy, Stress physiology, Mechanisms of stress acclimation in plants, Physiological adaptive responses of plants to abiotic and biotic stress, Climate change and ecophysiology

Course Aim: The aim is to give the students increased knowledge of physiology, metabolism and structure of plants together with a better understanding of regulation of growth, activity and functions and environmental influence. Further interested in how plants respond to changes in their sometimes hostile environment and how they in turn effect this environment to their benefit. This course is also designed to enable students to learn modern concepts in plant physiology and use that knowledge to answer practical questions that is ultimately the basis of the crop production.

Course ILOs: At the end of the course, the student should be able to

1. describe plant mechanisms for the soil plant atmosphere continuum.
2. analyze the mechanisms of acquisition and assimilation of nutrients (nitrogen, phosphorus potassium, iron) by plants
3. describe photosynthesis as a form of autotrophic nutrition, factors affecting it and photosynthetic mechanisms which have the plants according to the adaptation to the environment in which they live
4. identify the mechanisms of transport of photoassimilates, patterns of partitioning and factors affecting it
5. identify the physiological factors and plant hormones that regulate growth and developmental processes of plants and clearly define their roles
6. identify structure, occurrence and biosynthesis of the plant secondary metabolites and their role on plant growth and development

7. examine the physiology of plant adaptation to their environments and explain their defense mechanisms
8. describe the processes of development and fruit ripening and the process of germination and seed dormancy and its role in the survival of plants.
9. apply analytical techniques such as HPLC and GC/MS to identify some secondary metabolites including interpretation of data
10. demonstrate the application of plant physiology concepts to solve practical problems

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres, laboratory instruments, chemicals

Assessment Strategy:

Continuous assessment		-30%
Mid- semester and class test	-20%	
Presentations/quizzes	-05%	
Practical records	-05%	
End semester examination		-70%
Theory	-40%	
Practical	-30%	

References:

1. L Taiz and E Zeiger (2015) Plant Physiology, Fifth edition, Sinauer Associates Inc
2. JD Bewley, KJ Bradford, HWM Hilhors and H Nonogaki (2013) Seeds 3rd ed. Springer, NY
3. https://archive.org/stream/physiologyofflow00hill#page/n13/mode/2up (Fulltext of Physiology of Flowering)

Teaching Panel: Dr. W.M.G.A.S.T.B. Wijetunga (email: astbw@yahoo.com, Tel: 0777610876)
Mrs. P. Neelamani Yapa (email: pnyapa40@yahoo.co.uk)

Course Coordinator: Mrs. P. Neelamani Yapa

Course Name: Plant Pathology

Course Code: BOT 2202 (Theory 25 hrs, Pract. 15 hrs, IL 40 hrs)

Course Capsule: Introduction to plant pathology, development of diseases in plants, effects of pathogens on plant physiological functions, environmental effects on the development of disease, genetics of plant disease, plant disease epidemiology, methods of attack by plant pathogens, defense mechanisms of plants against plant diseases, diagnosis of plant diseases, control and management of plant diseases, plant diseases caused by fungi, plant diseases caused by bacteria, plant diseases caused by viruses, plant diseases caused by nematodes, plant diseases caused by parasitic higher plants.

Course Aim: To mediate basic knowledge in ecology of plant pathogens, disease diagnosis, epidemiology & control of plant disease and molecular methods for the study & characterization of plant pathogens, using an array of assessment techniques and to

provide a detailed understanding of basic and applied plant pathology and the issues associated with current production systems and control strategies.

Course ILOs: At the end of the course the student should be able to;

1. interpret the processes and mechanisms involved in plant biotic and abiotic diseases
2. infer the plant disease and their importance
3. describe the symptoms and signs which occur due to plant diseases
4. exemplify the losses caused by plant diseases and the control measures
5. recognize and compare the infectious disease causative agents and environmental factors
6. implement the knowledge on plant pathology to identify plant diseases in the field and in the laboratory
7. outline different techniques that are used for plant pathogen detection in the field and in the laboratory
8. construct different approaches for plant disease management in the field

Resource Requirements: Handouts, Multimedia projector, laboratory, lecture theatre

Transport Requirements: A bus is required to go to the Field Crops Research and Development Institute (FCRDI), Mahailluppallama from the Faculty premises.

Assessment Strategy:

Continuous assessments		-30%
	Essay	-05%
	Presentations	-15%
	Mid semester assessment	-10 %
End semester examination		-70%
	Theory	-50%
	Practical examination	-15%
	Oral examination	-05%

References:

1. GL Schumann and CJ D'Arcy (2010) Essential plant pathology. 2nd ed. The American Phytopathological Society, St. Paul, Minnesota, U.S.A
2. GN Agrios (2005) Plant pathology, 5th ed. Academic Press, New York
3. RK Horst (2001) Wescott's Plant disease handbook, 6th ed. Kluwer Academic Publishers, Massachusetts

Additional Reading

American Phytopathological Society: http://www.apsnet.org/
USDA Plants Database: http://plants.usda.gov/
Plant Diagnostic Information System: http://www.pdis.org/

Teaching Panel: Dr. T. C. Bamunuarachchige (email: heroiraj@gmail.com, Tel: 071-8096400)
Mr. Gayan D. Abeysinghe (email: gayandak1@gmail.com, contact: 071-5601760)

Course Coordinator: Mr. Gayan D. Abeysinghe

Course Name: **Flora of Sri Lanka**

Course Code: **BOT 2203** [Theory 18 hrs, Pract. 35 hrs (Lab. 8 hrs+ Field 27 hrs), IL 27 hrs]

Course Capsule: Introduction and significance of studying floristic diversity of Sri Lanka, Climatic conditions and vegetation classification of Sri Lanka, Floristic regions of the Island, Salient plant-animal interactions in the natural forests of Sri Lanka, Natural (Wet, Dry and Montane Zones) and man-made vegetation types and forest and non-forest vegetation of the island, Structure and floristic composition of main vegetation types, Special floral groups (Aquatic plants, Parasitic plants, Carnivorous plants, Orchids, Wild flowers, Xerophytes etc.), Threats on the flora of Sri Lanka, conservation and management issues of forest products and resources.

Course Aim: To review the knowledge on the vegetation types of Sri Lanka, their structure (physiognomy), floristic composition, intrinsic values, conservation and management issues, sustainable utilization of the resources and services of the island's forests and flora with the intention of giving a better inspiration for the high diversity of the forest biota and the increasing threats on them.

Course ILOs: At the end of the course, the students should be able to

1. describe the distribution and the characteristics of main vegetation types/biomes of the world and to review the position of Sri Lanka among them
2. determine the relevant possible vegetation type for a given set of climatic and edaphic conditions, i.e. to determine climatic climax for a given region
3. review the salient plant-animal interactions in the natural forests of Sri Lanka
4. describe the characteristic features of the forest and non-forest vegetation of the country with representative dominant floristic elements and their characteristic features, with special emphasis on Lowland Rain Forests, Dry Zone Forests and Montane Forests
5. distinguish natural and man-made vegetation systems, forest and non-forest communities and familiarize with endemics, indigenous and exotic flora existing in them
6. identify the pioneers, secondary forest species, climatic climax species and the succession type and the successional stage of a system
7. distinguish the category and describe the characteristic features of the special floral groups such as hydrophytes, xerophytes, mangroves, marine angiosperms, orchids, parasitic plants, carnivorous plants, wild flowers, etc.
8. assess the sustainable utilization of products (extractive) and to be familiar with the management of services (non-extractive) of the diverse vegetation of Sri Lanka
9. identify the threats to the flora of Sri Lanka, conservation issues and priorities
10. propose remedies to mitigate the harmful effect on flora of the island

Resource Requirements:

Lecture: Lecture Theater, Handouts, Multimedia, Computers, White board,

Practical: Practical Schedules, Live specimens, Laboratories, Light Microscopes, Stereoscopic Microscopes, Trays, Slides & Cover-slips etc., Filed collecting devices and bags, materials needed for herbarium techniques

Transport Requirements: Bus or van for three 2-day field visits and three 1-day field visits

Assessment Strategy:

Continuous assessment (CAM)		-40%
Assignments	-10%	
Seminars (Am)	-10%	
Mid semester exam (Ms)	-20%	
End semester assessment (EAM)		-60%
Theory (ET)	-40%	
Practical (EP)	-20%	

References:

1. PS Ashton and CVS Gunatilleke (1987) New light on the plant geography of Ceylon. I. Historical plant geography. *Journal of Biogeography*, **14**: 249-285.
2. CVS Gunatilleke, PS Ashton (1987) New light on the plant geography of Ceylon II. The ecological biogeography of the lowland endemic tree Flora. *Journal of Biogeography*, 14: 295-327.
3. CVS Gunatilleke and IAUN Gunatilleke (1990) Distribution of floristic richness and its conservation in Sri Lanka. *Conservation Biology*, 4 (1): 21-31.
4. N Gunatilleke, R Pethiyagoda and S Gunatilleke (2008) Biodiversity of Sri Lanka. *J. Natn. Sci. Foundation, Sri Lanka*, 36 (Special Issue): 25-62.
5. A Pemadasa (1996). The green mantle of Sri Lanka. An Author Publication. Pp 242.

Teaching Panel: Dr. W.M.G. Asanga S.T.B. Wijetunga (e-mail: astbw@yahoo.com; Tel: 777610876)
Dr. Priyani L. Hettiarachchi (phlakshmi@yahoo.com; Tel: 0771238980)

Course Coordinator: Dr. W.M.G. Asanga S.T.B. Wijetunga

Course Name: Animal Histology and Physiology

Course Code: ZOO 2201 (Theory-32 hrs, Practical: 14 hrs IL 34 hrs,)

Course Capsule: Form & Function: Locomotion, Digestion, Circulation, Respiration; Regulation: sensory and nervous system, Endocrine system, Immune System, Homeostasis, Reproduction: Reproductive strategies of animals: Male and Female eproductive systems, Physiology of human reproduction and different types of tissue level organization of each system.

Course Aim: To develop an all-round understanding of the structural and functional properties of animals at different levels (i.e., cell, tissue, organ, organism).

Course ILOs: At the end of the course, the students should be able to

1. explain the structure and tissues level organization of major organ systems of animals (especially vertebrates)
2. describe the relationships between structure and physiological function of organ systems in animals (especially vertebrates)
3. explain the mechanisms by which the organ systems of vertebrates operate and functions coordinated.

4. differentiate the mechanisms involved in the regulatory processes of animals
5. conduct experiments to relate theoretical knowledge in animal physiology to observations and experimental data

Resource Requirements: Handouts (Practicals), multimedia projector, computers, laboratories, lecture theatres

Transport Requirements: None

Assessment Strategy:

Continuous assessment:		-35%
Quizzes/Assignments	-10%	
Practical records	-05%	
Mid-semester examination	-20%	
End semester examination		-65%
Practical	-15%	
Theory	-50%	

References:

1. D Randall, K French (2002) Eckert Animal physiology: Mechanisms & Adaptations. 5th ed.. McMillan Higher Education.
2. P Raven. GB Johnson, KA Mason, JB Losos & S Singer (2013) Biology. 10th ed. McGraw Hill, Boston.
3. K Schmidt-Nielsen (1997) Animal Physiology: Adaptation and Environment. Cambridge University Press.

Teaching Panel: Dr. Kanishka Ukuwela, (email: kanishkauku@gmail.com)
Dr. Manel Goonasekera (email: manel.goonasekera@gmail.com)

Course Coordinator: Dr. Manel Goonasekera

Course Name: **General Entomology**

Course Code: **ZOO 2202** (Theory 23 hrs, Pract 20 hrs, IL 40 hrs)

Course capsule: Characteristics of the Phylum Arthropoda, Introduction to entomology, Insects and their relatives, Insect body plan, Evolution of body regions, Segmentation, Head and head appendages, Thorax and thoracic appendages, Abdomen and abdominal appendages; Metamorphosis, Integument, Digestive system, Respiratory system, Circulatory system, Excretory system, Sense organs, Nervous system, Reproductive system, Insect diversity**,** Insect collection methods and preservation techniques

Course Aim: To inculcate appreciation of the value and importance of insect, factors contributing to the success of insects and to teach their classification, biology and ecology, to provide skills in required in field and in the laboratory

Course ILOs: At the end of the course students should be able to

1. Describe the characteristic features of Phylum arthropods

2. Appreciate the value and importance of insects
3. Understand the destructive nature of the insects
4. Identify an organism as an insect
5. Understand structure and function of insect body
6. Identify major insect orders and families of insects
7. Acquire skills for collecting, mounting, and preserving insects for scientific study

Resource Requirements: Sophisticated dissecting microscopes and insect trapping equipment are needed. Modern insect storing boxes are required for preservation of Insect.

Transport Requirements: Vehicle is needed for three field visits

Assessment Strategy:

Continuous assessments		-40%
Quizzes	-10%	
Preparation of insect box	-10%	
Group presentation	-10%	
Mid semester theory examination	-10%	
End semester examination		-60%
Theory	-40%	
Practical	-20%	

References:

1. R J Elzinga (2003) Fundamentals of Entomology, 6th ed. Prentice-Hall. Inc. Englewood Cliffs, New Jersey 07632
2. NF Johnson and CA Triplehorn (2004) Borror and Delong's Introduction to the Study of Insects 7th ed. Brooks Cole

Teaching Panel: Dr P.M. Wijeratne

Course Coordinator: Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Name: Animal Behaviour

Course Code: ZOO 2203 (Theory 28 hrs, Pract. 6 hrs, IL 46 hrs)

Course Capsule: Animal behaviour and human society (why study animal behaviour?), proximate and ultimate explanations of animal behaviour, testing hypotheses in animal behavior studies, hormones and neurobiology, Learning and cultural transmission, predators and antipredatory behaviour, sexual selection, mating systems, kinship, cooperation, living in groups, foraging, habitat selection, play behaviour, behavior sampling methods, use of specialized software such as UCINET and idTracker.

Course Aim: To introduce students to key theoretical concepts in behavioral ecology, develop the ability of students to read and understand primary scientific literature**,** instill the belief that the course can help develop valuable transferable skills such as writing and presentation skills, develop attitudes such as initiative (IN), responsiveness (RS), leadership skills (LE) and lifelong (LL) and cooperative learning (CL) in students.

Course ILOs: At the end of the course, students should be able to

1. describe key theoretic concepts in the field of behavioral ecology

2. identify proximate and ultimate hypotheses to explain animal behaviour
3. read primary scientific literature on animal behaviour
4. describe methods used in the sampling of animal behaviour
5. use behavioral sampling techniques to collect behavioural data and test hypotheses
6. use of specialized software to analyze animal behavior

Resource Requirements: Computers with the relevant software, a video camera and binoculars

Transport Requirements: Not required

Assessment Strategy:

Continuous assessment		-40%
Group presentation	-10%	
Practical report 1	-15%	
Practical report 2	-15%	
End Semester Theory Examination		-60%

References:

1. NB Davies, JR Krebs and SA West (2012) An Introduction to Behavioural Ecology. Wiley-Blackwell, Oxford.
2. LA Dugatkin (2013) Principles of Animal Behavior. Norton & Company, New York.

Teaching Panel: Dr. Rajnish P Vandercone (email: vandercone@gmail.com)
Dr. Kanishka Ukuwela (kanishkauku@gmail.com)

Course Coordinator: Dr. Rajnish P Vandercone

Course Name: Fish Biology

Course Code: ZOO 2204 (Theory 25 hrs, Pract. 15 hrs, IL 21 hrs)

Course Capsule: Taxonomy and evolution of fish, common fish species of Sri Lanka, morphometric and meristic characteristics of fish, general anatomy and physiology – digestive system, food and feeding habits, circulatory system, osmoregulation, nervous and endocrine systems, sensory systems; growth and age determination, fish behaviour, reproductive biology and life histories.

Course Aim: To teach the taxonomy, evolution, form and function of fish and identify common fish species of Sri Lanka.

Course ILOs: At the end of the course, the student should be able to

1. explain the evolution of fish and taxonomy

2. describe the different types of locomotion and how the fish overcome the problems in locomotion
3. describe the different type of feeding habits of fish
4. explain digestion and absorption of food in different parts of alimentary canal
5. explain the structure and function of heart and blood circulation
6. discuss the structure of gills and different types of respiratory patterns of fish
7. analyze osmoregulation in freshwater teleosts, marine teleosts and marine elasmobranchs
8. describe the structure and function of different sensory systems viz. eye, ear, olfactory, lateral line organ, gustatory
9. discuss the male and female reproductive systems, different patterns of reproduction
10. analyze the different types of fish behavior viz. parental care, migration
11. determine the age of fish and condition factor of fish

Resource Requirements: Handouts, Multimedia, computers, live specimens, laboratories, lecture theatres

Transport Requirements: no field visits required

Assessment Strategy:

Continues assessment -25%
- Quizzes -10%
- Mid semester -15%

End semester Examination -75%
- Theory-50%
- Practical-25%

References:

1. T Bagenal (1978) Methods for Assessment of fish Production in Freshwaters. Blackwell science Inc.
2. Q Bone, NB Marshall and JHS Blaxter (1985) Biology of Fishes Chapman and Hall.
3. R Pethiyagoda (1991) Freshwater Fishes of Sri Lanka, Wildlife Heritage Trust.
4. GHP De Bruin, BC Russell and A bogusch. 1994. The marine fishery resources of Sri Lanka, FAO.
5. GS Heffman, BB Collete and DE Facey (1997) The Diversity of Fishes, Blackwell Science, U.K.
6. PR Moyle and JJ Cech (2000) Fishes - Introduction to Ichthyology, Prentice Hall, NJ.
7. S de Alwis Gunathilake. (2007) Freshwater Fishes of Sri Lanka. Ministry of Environment and Natural Resources, Sri Lanka.
8. M De Silva, N Hapuarachchi and T Jayaratne. (2015) Sri Lankan Freshwater fishes. Wildlife conservation society, Galle.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (Email: tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: Systematic Biology

Course Code: BIO 2201 (Theory 36 hrs, Pract. 27 hrs, IL 57 hrs)

Course Capsule: What is systematics, Fundamental concepts in systematics, Phenetics/ Numerical taxonomy, Phylogenetics/ Cladistics, Evolutionary Taxonomy, Species Concepts, Characters in Systematics: Morphological and Biochemical, Animal taxonomy: History of Animal taxonomy, Basics of animal taxonomy, Zoological nomenclature, Plant taxonomy: History of plant taxonomy, Importance and objectives, Is this science needed in the 21st century? (Fascinating applications of plant taxonomy), Plant identification, Plant classification including briefly the historical development of different systems, Plant nomenclature emphasizing certain areas in ICBN, Field and herbarium techniques, Policies and regulations in field collections, Sources of taxonomic evidence including micro molecules and proteins, Historical development of plant taxonomy in Sri Lanka.

Course Aim: To develop an understanding of modern conceptual and methodological ideas in studying the biological diversity of earth through evolutionary relationships among organisms, species, higher taxa, or other biological entities, and address its' wider relevance to areas such as biodiversity conservation, to introduce the fundamental concepts of animal taxonomy and nomenclature, to view Plant Taxonomy as an omniscient science and to appreciate its applications, get familiar with the literature available and methods used for studying plants with respect to taxonomy, master the herbarium techniques and to learn legislation regarding field collection, critically evaluate the use of taxonomic evidence in plants and to learn the modern methods of grouping, learn to appreciate the effort made by scientists to develop plant taxonomy in Sri Lanka.

Course ILOs: At the end of the course the student should be able to

1. describe the key conceptual foundations of systematics at multiple levels (genus, species, higher taxa), using appropriate terminology
2. define and explain the ecological and evolutionary processes that give rise to present-day diversity of living organisms in both space and time
3. amalgamate taxonomic data from diverse sources (including both traditional and molecular data) and derive taxonomic relationship among organisms
4. describe the conceptual framework of animal taxonomy and zoological nomenclature
5. explain the importance and applications of plant taxonomy (reasons as to why people working with plants should know this science)
6. identify and classify any plant using diverse literature available
7. clarify the existing identity, classification and name of any plant
8. prepare reference herbarium of plants for future use
9. appreciate the contribution of various scientists towards the development of plant taxonomy in Sri Lanka

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres, live and preserved plant and animal specimens, computer laboratory

Transport Requirements: A bus for the field visit to Peradeniya

Assessment Strategy:

Continuous assessment -50%

Mid- semester and class tests -20%

Herbarium and assessment of Practicals -30%

End semester Examination (theory) -50%

Practical skills will be assessed continuously in the class work (No end semester practical exam).

References:

1. AK Mondal (2011) Advanced Plant Taxonomy, New Central Book Agency (P) Limited
2. C Pandey and S Misra (2008) Taxonomy of Angiosperms, Ane Books (P) Limited, India
3. MG Simpson (2010) Plant Systematics. Academic Press
4. WC Wheeler (2012) Systematics: a course of lectures. John Wiley & Sons.
5. JE Winston (1999) Describing Species: Practical Taxonomic Procedure for biologists. Columbia University Press, New York.

Teaching Panel: Dr. (Mrs.) P.L. Hettiarachchi (email: phlakshmi@yahoo.com, Tel: 0771238980)
Dr. W.M.G.A.S.T.B. Wijetunga (email: astbw@yahoo.com, Tel: 0777610876)
Dr. K.D.B. Ukuwela (email: kanishkauku@gmail.com, Te: 0776767379)

Course Coordinator: Dr. (Mrs.) P.L. Hettiarachchi

Course Name: **Principles of Ecology**

Course Code: **BIO 2302** (Theory 25 hrs, Pract. 40 hrs, IL 55 hrs)

Course Capsule: Nature of Ecology, Physical Environment, Climate and its effect on environment, Aquatic environment and terrestrial environment: Climate, Plant and light, Soil formation and its origin, Soil profiles; Soil characteristics: Physical and chemical properties; Population Ecology of Single Species: Population size estimation, Population growth, Geometric Growth, Exponential Growth, Density-dependent growth & dispersal, Meta-populations, Landscapes; Properties of population: Quantitative population studies, Population growth and life tables Life history- Age specific mortality, Reproductive effect, Number and size of offspring, Genotype and the environment, Mating systems, Sexual selection and pattern of life history characteristics, External selective forces; Interactions Between Two Species: Competition, Limited resources and competition; Intraspecific and Interspecific Competition, Competition in complex environments; Predation, Herbivory, and Parasitism, Optimal foraging, Functional responses, Predator-prey cycles &Evolutionary arms race. Community structure and dynamics: Disturbance and succession, Food chain length and indirect effects, Top-down vs. Bottom-up Control, Community stability, Primary production, Nutrient cycling and Energy flow, Secondary production and trophic efficiency, Community dynamics. Landscape dynamics and Human ecology, Analysis of ecological data using statistical software packages

Course Aim: The main goal of this course is to introduce to the fundamental ecological concepts that describe the complex dynamics present between organisms and their environment at the levels of the individual, population, and community. Also this course will provide undergraduate students with a fundamental understanding of the major theories and concepts of modern ecology, and how they apply to the natural world and to contemporary issues involving humankind. Further student will engage in Sampling techniques in terrestrial and aquatic habitats, Physico-chemical and biological characteristics of water bodies, Diversity indices, Quantitative population studies, horizontal zonation, Ecology of disturbance and patch dynamics, Gap theory, Niche theory

and speciation, Intermediate disturbance hypothesis. In the laboratory work which will offer student's hands-on opportunities to examine natural systems, and to collect, analyze and interpret data. This will be structured to allow students to develop conceptual, analytical and critical thinking skills.

Course ILOs: At the end the course, students should be able to

1. appreciate how an understanding of evolutionary processes informs the study of ecology and identify the abiotic and biotic factors involved maintaining the ecosystem
2. recognize the importance of pedology in ecological balance in the nature
3. describe ecosystem patterns and processes in the nature
4. demonstrate knowledge of the important ecological principles that operate at the levels of the individual organism, the population, the community, and the ecosystem
5. examine the population structure and dynamics in the context of demographic life history tables the evolution of life history patterns and apply basic mathematical model for calculate population data.
6. express how organisms' interactions with their environment and other organisms give rise to patterns in their abundance and distribution
7. discuss the range of factors that can influence the regulation of population size in natural and managed conditions
8. describe the population interactions to minimize the competition on resource utilization among species and study the ecological significance of temporal and spatial scales.
9. examine how land use and other resource use decisions influence ecological processes and patterns.
10. use sets of observations and data to formulate research questions, hypotheses, predictions design and show familiarity with common approaches for analysis ad graphical representation of ecological data.

Resource Requirements: Handouts, Multimedia, computers, lecture theatres, White board, Field equipment, LMS RUSL, Laboratory

Transport Requirements: Five field visits

Assessment Strategy:

Continuous assessment		- 35%
mid- semester	-10%	
quizzes	-05%	
group presentations	-10%	
practical records	-10%	
End semester assessment		-65%
Theory	-45%	
Practicals	-20%	

References:

1. ARE Sinclair, JM Fryxell and G Caughley (2006) Wildlife ecology, conservation, and management 2nd ed. Blackwell publisher, ISBN-13: 978-1-4051-0737-2
2. G Jr Tylermiller and S Spoolman (2009) Essentials of Ecology- 4th ed. Brooks/Cole, Cengage Learning, .ISBN-13: 978-0-495-55795-1

3. TM Smith and RL Smith (2011) Elements of Ecology 8th ed. Benjamin-Cummings Publishing Company, ISBN 13: 9780321736079

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)
Dr. Rajnish P.G. Vandercone (email: vandercone@gmail.com, Tel: 075615222)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: Genetics and Evolution

Course Code: BIO 2203 (Theory-27 hrs, Pract. 09 hrs, IL -44 hrs)

Course Capsule: Heredity: Early ideas on heredity, Mendelian and non-Mendelian patterns of inheritance, Population genetics, Genetic disorders and genetic counseling, Mutations and cancer, Barr bodies and sex determination, Determination of blood groups, Karyotyping, Translocation and behavior of chromosomes in meiosis, History of evolutionary biology, Concepts in microevolution (Adaptive evolution and neutral evolution, The origin and maintenance of genetic variation, Development in evolution), Concepts in macroevolution, Human evolution.

Course Aim: To develop and enhance the understanding of heredity through Mendelian and non-Mendelian modes of inheritance, to foster the understanding of mechanisms and processes that maintain and regulate the genetic composition of populations, to improve knowledge on the genetic disorders , their patterns of inheritance and apply those in genetic counseling, appreciate the applications of knowledge gained, in forensic science, enable students to differentiate scientific theories from non-scientific theories, develop an appreciation for the history of evolutionary biology, create an understanding of microevolution and macroevolution, develop an overview of human evolution.

Course ILOs: At the end of the course, the student should be able to

1. describe Mendelian and non-Mendelian modes of inheritance that govern inheritance of genetic traits across generations
2. explain how the genetic composition of a population is maintained and the forces that change the genetic composition
3. comment on the diseases caused by genetic disorders , their patterns of inheritance and to determine some using Barr bodies
4. provide guidance to a family with history of genetic disorders
5. perform blood typing and karyotyping
6. differentiate scientific theories for non-scientific theories
7. state key historical landmarks in the development of modern evolutionary theory
8. compare and contrast key concepts in microevolutionary and macroevolutionary theories
9. describe key events in human evolution

Resource Requirements: Handouts, multimedia projector, computers, laboratories, lecture theatres

Transport Requirements: None

Assessment Strategy:

Continuous assessment:	-30%
Assignments	- 20%
Mid-semester	-10%
End semester examination	-70%

References:

1. P Raven, G Johnson, K Mason, J Losos and S Singer (2013) Biology. 10th ed. McGraw Hill, Boston.
2. SC Stearns and RF Hoekstra (2005) Evolution- an introduction. 2nd ed. Oxford University Press

Teaching Panel: Dr. Kanishka Ukuwela (email: kanishkauku@gmail.com)
Dr. Rajnish Vandercone (email: vandsercone@gmail.com)

Course Coordinator: Dr. Rajnish Vandercone

Course Name: **Scientific Communication**

Course Code: **IDC 2202** (Theory 30 hrs; 50 IL hrs)

Course Capsule: The importance of scientific communication, types of scientific communications, types of scientific papers, structure of a scientific paper, citation styles and bibliographic software, selecting a journal, the peer-review process, responding to reviewer comments, ethics of scientific publishing (COPE), Oral communication and presentation aids, preparing effective PowerPoint presentations and effective delivery of presentations, handling questions, structure of a proposal and effective proposal writing, preparing a budget and budget justification.

Course Aim: To introduce students to the different types of scientific communications, develop scientific writing skills, introduce students to publication ethics, enhance oral scientific presentation skills and proposal writing skills of students and instill the belief that writing, presentation and proposal writing are transferrable skills (TS), develop attitudes such as initiative, responsiveness, leadership skills and lifelong and cooperative learning in students.

Course ILOs: At the end of the course, students should be able to

1. state the importance of scientific communication
2. describe the different types of scientific communications
3. describe different types of scientific papers
4. describe the basic structure of a scientific paper and the key features of each section of a scientific paper
5. state the basic information that needs to be included in a scientific reference
6. describe the manuscript submission process and state the basic steps in the peer review process
7. describe three major ethical issues pertaining to scientific publishing
8. prepare and conduct a PowerPoint presentation
9. write a short scientific proposal

Resource Requirements: A temporary academic staff member needs to be permanently assigned to the course to ensure that assignments are assessed in a timely manner. Sufficient stationary for the preparation of handouts

Transport Requirements: Not required

Assessment Strategy:

Continuous assessment		-50%
Group presentation	15%	
Cover letter	15%	
Proposal	20%	
End Semester Theory Examination		-50%

References:

1. M Cargill, P O'Connor (2013) Writing Scientific Research Articles: Strategy and Steps. Wiley-Blackwell

Teaching Panel: Dr. Rajnish P Vandercone (email: vandercone@gmail.com)
Dr. T. Chathuranga Bamunuarachchige (email: heroiraj@gmail.com)

Course Coordinator: Dr. Rajnish P Vandercone

Course Name: Principles and Practices of Marketing

Course Code: IDC 2203 (Theory 30 hrs, IL 50 hrs)

Course Capsule: Marketing as an organizational function (introduction), Core marketing concepts, Marketing environment and environment analysis, Orientations of marketing, Consumer behavior, Segmenting , targeting and positioning, Marketing mix, Product and branding strategies, Pricing strategies, Marketing channels and strategies, Promotional strategies, Preparation of a marketing plan.

Course Aim: This course provides an introduction to all aspects of marketing, including consumer behavior, marketing environment and product, price, distribution and promotional strategies. It provides an understanding of the theories of the marketing mix variables, and through preparation of marketing plan provides more exposure to students get practical experience.

Course ILOs: At the end of the course, the student should be able to

1. explain broad view about organizations and marketing management
2. analyze markets and customers utilizing primary and secondary sources of information
3. define and apply knowledge of key concepts such as: market segmentation target market selection positioning
4. identify and explain the elements of the marketing mix and be able to discuss how they are integrated into a comprehensive plan
5. explain the value of building a brand and the necessary steps required to accomplish and maintain a successful brand in the market

6. list and describe the elements of marketing plan and preparation of a successful marketing plan

Resource Requirements: Handouts, Multimedia, computers

Transport Requirements: No field visits outside the University

Assessment Strategy:

Continuous assessment -40%
Marketing Plan - 30%,
Presentations - 10%

End semester assessment -60 %

References:

1. PT Kotler (2011) Marketing Management 14th ed. Prentice Hall

Teaching Panel: To be identified

Course Coordinator: Prof. Sanath Hettiarachi

Third Year

Course Name: Plant Tissue Culture

Course Code: BOT 3201(Theory 21 hrs, Pract. 27 hrs, IL 32 hrs)

Course Capsule: Introduction and history of plant tissue culture; Techniques, equipment andmedia; ***In-vitro*** **methods in plant tissue culture** such as micro propagation, callus , suspension culture, meristem and organ culture, regeneration and morphogenesis, **Role of PGRs in plant tissue culture,** Cryopreservation**, Crop improvement techniques** : haploid cultures, somaclonal variation, protoplast isolation, culture and fusion, embryo rescue cultures, Genetic transformation and production of transgenic plants. *In-vitro* production of secondary metabolites, Plant Cell Bioreactors, Current status of the application of tissue culture in Sri Lanka, Entrepreneurship in the 21st century, intellectual property protection for plants

Course Aim: To teach ***In-vitro*** **methods in plant tissue culture** so that students would appreciate its applications in diverse fields such as agriculture and medicine, master the techniques in plant tissue culture, and learn legislation regarding GM plants, critically evaluate the current use of tissue culture techniques in plants, as an income generating avenue in Sri Lanka.

Course ILOs: At the end of the course the student should be able to

1. explain the underlying principle and methods in plant tissue culture
2. explain the role of different components of a tissue culture medium and the importance of maintaining specific conditions
3. describe precisely the applicability of tissue culture techniques in crop improvement
4. appreciate the possible contribution of tissue culture in pharmaceutical industry

5. utilize the knowledge and practical skills gained during the course to design a program to initiate an enterprise in plant propagation
6. produce plants to suit human desires but within the ethical framework

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres, live plant material, green house/ plant house, poly tunnel

Transport Requirements: A bus to visit a successful tissue culture venture

Assessment Strategy:

Continuous assessments		-50%
Mid semester	-10%	
Quizzes	-10%	
Assignments	-10%	
Mini project	-20%	
End semester examination		-50%
Theory	-30%	
Practicals	-20%	

References:

1. H Scoggins and M Bridgen (2013) Plants from test tubes: An Introduction to plant propagation. 4th ed. Timber Press
2. RH Smith (2013) Plant tissue culture: Techniques and experiment 3rd ed. Academic Press
3. RN Trigiano and DT Gray (2011) Plant tissue culture, Development and biotechnology, Kluwer
4. BW Sathyanarayana (2007) Plant tissue culture: Practice and new experimental protocols, IK International Publishing House
5. S Narayanaswamy (1994) Plant cell and tissue culture. Tata McGraw-hill

Teaching Panel: Dr. T.C. Bamunuarachchige (email: heroiraj@gmail.com, Tel: 0718096400)
Dr. (Mrs.) P.L. Hettiarachchi (email: phlakshmi@yahoo.com, Tel: 0771238980)

Course Coordinator: Dr. (Mrs.) P.L. Hettiarachchi

Course Name: Principles and practice of Horticulture and Landscaping

Course Code: BOT 3202(Theory 24 hrs, Pract. 18 hrs, IL 38 hrs)

Course Capsule: Importance and limitations of horticulture, Methods in propagating horticultural plants, Techniques in improving horticultural plants, Use of plant growth regulators and related chemicals in horticulture, Manipulating tree architecture (physical control), Methods of controlling external environment, Methods employed, advantages and limitations of hydroponics, Postharvest (PH)handling of horticultural products, Introduction to legislation related to horticulture, Feasibility and future prospects of horticulture and floriculture as an industry in Sri Lanka, Focal points in landscaping, Styles of gardening, Types of gardening, Indoor gardening, Rooftop gardening, Landscaping sites of public importance, Horticulture and landscaping as a business venture.

Course Aim: To teach methods in propagating and improving horticultural plants, the manner and importance of proper postharvest handling of horticultural products, obtain maximum benefit of existing topography, its natural flora and natural objects in landscaping,convert and maintain a pleasant environmentand appreciate horticulture and landscaping as income generating avenues in Sri Lanka.

Course ILOs: At the end of the course the student should be able to

1. explain the underlying principle and methods in improving quality of horticultural plants
2. explain the role of different chemicals used in horticulture
3. describe the factors important in deciding shelf life of horticultural products
4. design landscape styles while appreciating the existing topography and natural objects

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres, live plant material, green-house/ plant-house, poly tunnel, chemicals

Transport Requirements: A bus to visit HORDI, RBG Peradeniya, Postharvest Institute, a successful floriculture venture.

Assessment Strategy:

Continuous assessment		-50%
Mid- semester	-10%	
Quizzes	-05%	
Weekly assessment of practicals	-10%	
Presentations	-25%	
End semester examination		-50%
Theory	-35%	
Practicals	-15%	

References:

1. C Bird (2014) The Fundamentals of Horticulture - Theory and Practice , Royal Horticultural Society, Cambridge University Press, UK
2. M Beasley (2013). RHS propagation techniques, Octopus Publishing Groups Ltd, London
3. Adams A., Early M., Brook J and Bamford K (2012) Principles of Horticulture, Routledge, New York

4. T Waterman (2009) The Fundamentals of Landscape architecture, AVA Publishing, Swetzerland
5. A Toogood (2006) RHS propagating plants, Dorling Kindersley Publishing Business, England

Videos:

1. Sri Lankan Fresh Fruit & Vegetables Export Sectorhttps://www.youtube.com/watch?v=J4yIJT_-PZ8
2. Fruit & Vegetable Packing Trust Exporters Sri Lankahttps://www.youtube.com/watch?v=ABzXQzwbZBw
3. Growing Pineapple (Start to Finish) https://www.youtube.com/watch?v=sZAEYY7hU-Y
4. Sri Lankan Floriculture Export Sectorhttps://www.youtube.com/watch?v=vCyc1UdKWkQ

Teaching Panel: Dr. (Mrs.) P.L. Hettiarachchi (email: phlakshmi@yahoo.com, Tel: 0771238980)
Dr. W.M.G.A.S.T.B. Wijetunga (email:astbw@yahoo.com, Tel: 0777610876)

Course Coordinator: Dr. (Mrs.) P.L. Hettiarachchi

Course Name: Postharvest Technology of Plant Products

Course Code: BOT 3203 (Theory 24hrs, Pract. 18hrs, IL 38 hrs)

Course Capsule: Postharvest physiology of plant products, biological and environmental factors involved in deterioration, postharvest losses, postharvest diseases, preharvest management, harvesting and field handling, harvesting maturity, packing house operations, cooling, storage, transport, marketing, handling systems of minor commodities, minimal processing and modified atmosphere packaging, emerging technologies of postharvest disease management.

Course Aim: To provide students the fundamental aspects of postharvest technology including internal and external factors determining quality of postharvest products and technological and biological aspects focusing on proper handling and reduction of postharvest losses. Important factors such as maturity, harvesting, packing, cooling, storage, and transport will also be addressed with the view of preparing them to apply the knowledge gained in the course in real life and to practice as an income generating avenue.

Course ILOs: After completion of the course the students should be able to:

1. explain the underlying physiological and pathological aspects which can lead to postharvest diseases of plant products during ripening, harvesting, storage and distribution
2. identify various processing and preservation technologies appropriate for plant products
3. evaluate commercial procedures and skills required in harvesting, preparation, packaging, transportation, and storage of plant products
4. advise farmers how to reduce postharvest losses

5. develop novel cost-effective postharvest techniques which will be helpful in further development of the industry through value additions to the marketable products

Course Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Field visit outside the University

Assessment Strategy:

Continuous assessment	-20%
Essays	- 10%,
Presentations	- 10%
End semester examination	- 80%
Theory	- 50 %
Practical	-30%

References:

1. AA Kader (2002) Postharvest Technology of Horticultural Crops. 3rd ed. publication 3311. University of California, Division of Agriculture and Natural Resources, Oakland, CA
2. RBH Wills, WB McGlasson, D Graham and DC Joyce(2007) Postharvest –An introduction to the physiology and handling of fruit, vegetables and ornamentals. 5th ed. CAB International, Wallingford, UK 227 pp.

Teaching Panel: Mrs. P. Neelamani Yapa (email: pnyapa40@yahoo.co.uk, Tel: 0718265938)
Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 0771101501)

Course Coordinator: Mrs. P. Neelamani Yapa

Course Name: Economic Botany

Course Code: **BOT 3204** (Theory 16 hrs, Pract. 30 hrs, IL 34 hrs]

Course Capsule: Introduction to Economic Botany, Man's Association with Plants, Crop Plants and Their Domestication, Centers of Origin and Distribution of Cultivated Plants, Classification of Plants (in general), Crop Wild Relatives, Plant Breeding and Propagation (in general), Marketing of Crops and Crop Products, Human and Animal Nutrition, Human Food and Food Additives, Feed for Livestock, Food for Bees and other Desirable Invertebrates, Timber, Wood Products and Fuel, Vegetable Fibres, Phytochemicals, Plant Toxins and their Applications, Human and Veterinary Medicinal Plants, Useful Ferns, Bryophytes, Algae, Fungi, Bacteria and Viruses, Environmental and Social Uses, and Future Role of Plants in Relation to Mankind.

Course Aim: To review the knowledge on the botany of plants (characteristic features of plants and the plant parts of interest) which are of economic importance to man and livestock, their probable place of origin, economic importance of plants and plant products, preparation and processing of economically important products and extracts of plants; with the aim of giving a better motivation to admire the significance of plants and their products and to educate the correct way of utilizing them in a healthy and sustainable manner.

Course ILOs: At the end of the course, the students should be able to

1. justify the man's inseparable association with plants and plant products from his origin to date
2. identify the genus and/or species of the plants which are of major economic importance to man and his livestock, and assign them to their respective family
3. describe the characteristic botanical features of economically important plants and their families and features of other related organisms (ferns, bryophytes, algae, fungi, bacteria and viruses)
4. indicate the probable place of origin and the present areas of cultivation of crop plants
5. evaluate the economic importance of crop plants and other related organisms and the products obtained from them and asses the demand and marketability
6. analyze botanical features related with the economic importance of crop plants
7. describe the preparation and processing of major economically important products from plants and plant extracts, and other related organisms
8. state the basic breeding, propagation/cultivation and harvesting practices of major crops and other related organisms
9. evaluate the importance of crop wild relatives
10. review the future role of plants in relation to mankind and to emphasize the advantages and disadvantages of modern crop improvement

Resource Requirements:

Lecture: Lecture Theater, Handouts, Multimedia, Computers, White board

Practical: Practical Schedules, Live specimens, Plant Products, Laboratories, Light Microscopes, Dissecting/Stereoscopic Microscopes, Glassware, Trays, Slides & Cover-slips etc.

Transport Requirements: Bus for one 1-day field visit

Assessment Strategy:

Continuous assessment		-40%
Practical recordings	-05%	
Quizzes	-05%	
Assignments	-10%	
Mid semester exam	-20%	
End semester assessment		-60%
Theory	- 40%	
Practical	-20%	

References:

1. A Bendre and A Kumar (1982) *Economic botany: for university students*. Rastogi Publications. Pp. 275.
2. LS Cobley (1977) *An introduction to the botany of tropical crops 2nd ed.* Longmans, London. Pp. 371.
3. RN De Fonseka (2010) *Tree of life, The coconut palm (Cocos nucifera)*. Vijitha Yapa, Colombo, Sri Lanka. Pp 30.
4. D Hunter and V Heywood (2011) *Crop wild relatives; A manual of in situ conservation*. Earthscan, London, UK & Washington, USA.Pp. 414.

5. J Illankoon and A Wijesekara (2008)*Crop wild relatives of Sri Lanka and their conservation (in Sinhala)*. Crop Wild Relatives Conservation Project, Ministry of Environment and Natural Resources, Battaramulla, Sri Lanka. Pp. 32
6. SL Kochhar (2011) *Economic botany in the tropics 4th ed.* Macmillan, India. Pp. 664.
7. DV Liyanage (2001) *Coconut; The prince of plants*. Stamford Lake Publication, Pannipitiya, Sri Lanka.Pp. 69.
8. RK Maiti and VP Singh (2009) *An Introduction to modern economic botany*. Agrobios, Jodhpur, India.Pp. 384.
9. BP Pandey (2012) *Economic botany*. S. Chand & Company Ltd., New Delhi, India.
10. PA Weerasinghe (2009) *Botany of crops*. Rajarata University of Sri Lanka, Mihintale, Sri Lanka.Pp. 132.
11. GE Wickens (2001) *Economic botany; Principles and practices*. Springer Science + Business Media, New York. Pp. 535.

Teaching Panel:

Dr. W.M.G. Asanga S.T.B. Wijetunga (e-mail: astbw@yahoo.com; Tel: 0777610876)
Dr. Priyani L. Hettiarachchi (phlakshmi@yahoo.com; Tel: 0771238980)

Course Coordinator: Dr W.M.G. Asanga S.T.B. Wijetunga

Course Name: Medical Entomology

Course Code: ZOO 3201 (Theory 25hrs, Pract. 15hrs, IL 40hrs)

Course Capsule: Introduction to medical entomology, history of medical entomology, role of the medical entomologist, arthropods as medical importance, general characteristics of medically important arthropod orders (Orders – Scorpiones, Araneae, Acari, Thysanura, Blattodea, Hemiptera, Pthiraptera, Hymenoptera, Siphonaptera and Diptera), factors involved in vector-borne diseases, general disease cycle, methods of transmission, mechanisms by which arthropod vectors transmit parasites, characteristics of the arthropod element in the transmission cycle, biology, ecology and behavior of mosquitoes, biology, ecology and behavior of vectors other than mosquitoes (sand flies, tsetse flies, house flies, black flies, house flies, biting midges, fleas, lice, bed bugs, triatomine bugs, cockroaches, ticks and mites), major vector borne diseases in Sri Lanka and the globe, vector control, prevention and control of arthropod borne diseases, vector surveillance, emergence and resurgence of vector-borne diseases, environmental changes and vector-borne diseases.

Laboratory study of the external morphology of mosquitoes, identification characters of the order diptera, family culicidae and sub familes Anophelinae, Culicinae and Toxorhynchitinae, use of keys to identify mosquito species, different mosquito sampling techniques, vector-surveillance, identifying the vectors other than mosquitoes.

Course Aim: To introduce the natural history of the major groups of arthropods that impact the human health, their identification, the biology of vector-host-pathogen relationships, courses for incidence and existing and novel approaches for the control of vector-borne diseases

Course ILOs: At the end of the course, the student should be able to

1. describe the importance of arthropods for human health
2. explain the characteristics of major taxonomic groups of arthropods that important for human health
3. describe methods and mechanisms of pathogen/parasite transmission
4. identify the major drivers for spreading vector borne diseases
5. describe the biology, ecology and behavior of medically important arthropods
6. relate the role of vector borne diseases to global health
7. identify tactics and design suitable strategies for vector control

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: No field visits outside the University but field surveys will be carried out at the vicinity of university.

Assessment Strategy:

Continuous assessment		- 50%
Essays	-20%,	
Mid- semester and class test	-10%	
Presentations	-20%	
End semester assessment		- 50%
Theory	-30%	
Practicals	-20%	

References:

1. M Service (2012) Medical Entomology for students, 5th ed. Cambridge University Press
2. GR Mullen and LA Durden (2009) Medical and Veterinary Entomology, 2nd ed. Academic Press
3. BF Eldridge and J Edman (2003) Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods, Kluwer academic publishers
4. M Lehane (2005) The Biology of Blood Sucking Insects. Second Edition, Cambridge University Press
5. Recent review articles from Entomology and Epidemiology journals

Teaching Panel: Dr. Mangala Ganehiarachchi (email: mangala.ganehiarachchi@gmail.com, Tel: 0718483171)

Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Coordinator: Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Name: Applied Parasitology

Course Code: ZOO 3102 (Theory 11 hrs, Field visit 12 hrs, IL 17 hrs)

Course capsule: Introduction to parasitology, types of parasites, host parasite interactions, Introduction to the general biology of the parasitic protozoans, helminthes, nematodes,

mollusks, arthropods of humans and domestic animals. Study on morphology, taxonomy and function. Life cycles and pathogenesis of representative taxa of major groups of parasites, Importance of control of parasites, Methods of control of parasites, Field visits to Medical Research Institute to obtain field and laboratory experience of ecology and biology of parasites, Survey of parasites of domestic animals.

Course Aim: To teach the classification, biology, ecology, behavior, and control of parasites, their medical importance and controlling methods. Develop skills for collecting, mounting, and preserving parasites for scientific study.

Course ILOs: At the end the course, students should be able to

1. identify and classify parasites
2. identify the biological role of parasites
3. identify suitable methods to control a particular parasite
4. acquire field experience from professionals in health sector on assessment of parasites
5. preserve and mount parasites for scientific studies
6. develop report writing skills

Resource Requirements: Fresh specimens and newly mounted slides of parasites

Transport Requirements: Vehicle for the field visit to Colombo

Assessment Strategy:

Continuous assessments		-30%
Mid semester	-10%	
Mini-project	-10%	
Current topics	-10%	
End semester examination		-70%
Theory	-50%	
Practical	-20%	

References:

1. LS Roberts and J Janory (1996) Foundations of Parasitology 5th ed. Browa Publishers, Dubugue
2. W Peters and G Pasvol (2007) Atlas of Tropical Medicine and Parasitology 6th ed. Elsivier, Mosby
3. SH Gillespie and PM Hawkey (1995) Medical Parasitology: A practical approach. Oxford University Press
4. WC Marqurdt, RS Demaree and RB Grieve (2000) Parasitology and Vector Biology. Harcourt Academic, New York

Teaching Panel: Dr. P.M. Wijerathna
Mr. Ravindra Jayaratne (ravindrajayaratne@yahoo.com)

Course Coordinator: Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Name: Economic Entomology

Course Code: **ZOO 3203** (Theory 25 hrs, Pract. 15 hrs, IL 40 hrs)

Course capsule: Economically important insect and arachnid orders, definition of insect pest, population dynamics of insects, symptoms of damage caused by insect pests, economic decision levels for pest populations, insect pest outbreaks, pest management theory, evolution of pest control practices, cultural, mechanical, physical, biological, chemical, behavioural, legislative and genetically management of insect pests, host plant resistance to insects, integrated pest management, Novel methods of insect control; use of pheromones, Sterile insect techniques, juvenile hormone and genetic engineering, Insecticide formulations and their application, classes, mode of action, toxicity, LD50 value, and environmental impact; WHO classification of insecticides, Pesticide registration and legal requirements in Sri Lanka, biology and ecology of important insect and mite pests of rice, coconut, tea, sugarcane, selected fruit and vegetable crops and stored products, Insects of commercial value: apiculture (species of honeybees in Sri Lanka, Sri Lankan honey bee colony, division of labour in a honey bee colony, behavior of honeybees, management of a honey bee colony

Course Aim: To teach life history, ecology, economic importance, management of insect pests and mites, to provide the ability to sight-identify economically important species of insect and mite pests of major agricultural crops and stored products Sri Lanka and to introduce to rearing and management of bees for bee economic importance.

Course ILOs: At the end of the course, the students should be able to

1. identify the economically important insect orders using their characteristics
2. describe the symptoms of damaged caused by phytophagous insects and related arthropods
3. explain the economic decision levels for pest populations, insect pest outbreaks and causes for pest outbreaks
4. identify common insect and mite pests that are of economically importance in Sri Lanka and describe their biology
5. describe the life history, ecology and destructive nature of insect pests and mites of agricultural importance
6. describe the Insecticide formulations, their application, classes, mode of action, toxicity, LD50 value and prevention methods from insecticides
7. formulate economically and ecologically acceptable insect pest management strategies for controlling them
8. explain principles and practices of rearing of bees for honey and wax production

Resource Requirements: dissecting microscopes

Transport Requirements: Vehicle for field visits

Assessment Strategy:

Continuous assessment		-30%
Quizzes	-05%	
Report writing	-10%	
Mid semester examination	-15%	
End semester examination		-70%
Theory	-50%	

Practical -20%

Teaching Panel: Dr. P.M. Wijerathna
Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Coordinator: Mr. Ravindra Jayaratne (email: ravindrajayaratne@yahoo.com)

Course Name: Embryology and Developmental Biology

Course Code: ZOO 3204 (Theory 25 hrs, Pract. 15 hrs IL 40hrs)

Course Capsule: Mechanisms of Developmental Organization, Mechanisms of Developmental Patterning, Differential Gene Expression and Cell Differentiation, Cell-to-Cell Communication and Morphogenesis, Stem Cells, Gametogenesis, Fertilization, Early Development: Cleavage, Gastrulation and Axis Formation in Different Taxa (Protostome and Deuterostome Invertebrates, fishes, amphibians, reptiles, birds and mammals), Neural Tube Formation and Nervous System Patterning, Mesoderm and Its Derivatives, Endoderm Formation, Post Embryonic Development, Development in Health and Disease, Evolution and Development

Course Aim: To teach developmental organization and the regulation of animal development through different developmental mechanisms and the role of embryonic development in driving animal evolution by studying the development of representative animal taxa.

Course ILOs: At the end of the course, the students should be able to

1. discuss Developmental Organization
2. describe and discuss mechanisms of developmental patterning
3. review the role of stem cells in embryonic and post-embryonic development
4. compare and contrast key features of gametogenesis, fertilization, cleavage and gastrulation in different taxa
5. describe and discuss ectodermal patterning
6. describe and discuss mesodermal and endodermal patterning
7. review different forms of post-embryonic development
8. discuss the role played by embryonic and post-embryonic development in driving animal evolution

Resource Requirements: Handouts, multimedia projector, computers, laboratories, lecture theatres

Transport Requirements: None

Assessment Strategy:

Continuous assessments -30 %
- Assignments -10%
- Practical records -20%

End semester examination -70%
- Practical -45%
- Theory -25%

References:

1. M Jonathan and W Slack (2012). Essential Developmental Biology, 3rd ed. Wiley-Blackwell
2. SF Gilbert (2013) Developmental Biology, 10th ed. Sinauer Associates

Teaching Panel: Prof. EP Saman Chandana (email: epschandana@zoo.ruh.ac.lk)

Dr. Naveen Wijesena (email: naveenwijesena@gmail.com)

Course Coordinator: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com)

Course Name: Molecular Biology

Course Code: BIO 3201 (Theory 28 hrs, Practical 12 hrs, IL 40 hrs)

Course Capsule: Introduction to the hereditary material of life, DNA Replication in prokaryotes and eukaryotes, DNA repair, Transcription in prokaryotes and eukaryotes, RNA splicing, Prokaryotic translation, Eukaryotic translation, Principles of protein structure, Posttranslational modifications, Regulation of gene expression in prokaryotes and eukaryotes, DNA isolation and quantification, PCR techniques and its applications and gel electrophoresis.

Course Aim: To obtain and understand fundamental knowledge of molecular and cellular processes: gene regulation, RNA transcription, protein synthesis, protein targeting and how molecular machines are constructed and regulated so that they can accurately copy, repair and interpret genetic information. Students participate in laboratory sessions aimed at mastering basic techniques and tools for genome and proteome analysis which will assist in appreciating that molecular biology is a dynamic experimental science.

Course ILOs: At the end of the course, the student should be able to

1. describe the different concepts and basis of molecular biology
2. compare and contrast the mechanisms of bacterial and eukaryotic DNA replication, repair and transcription
3. explain how DNA topology and chromatin structure affects the processes of DNA replication, repair and transcription
4. describe mechanisms by which DNA can be damaged
5. describe how pre mRNA splicing occurs and how alternative splicing generates protein diversity
6. explain the molecular mechanisms behind different modes of gene regulation in bacteria and eukaryotes at both pre and post transcriptional levels
7. compare the differences between prokaryotic and eukaryotic translations
8. outline the posttranslational modifications and the protein structure
9. exemplify regulation of gene expression in prokaryotes and eukaryote
10. demonstrate hands on skills in molecular biology

Resource Requirements: Handouts, Multimedia projector, laboratory, lecture theatre

Assessment Strategy:

Continuous assessments		-30%
Quiz	-10%	
Group Activity	- 0%	
Mid semester	-10%	
End semester examination		- 70%
Theory	-60%	
Oral examination	-10%	

References:

1. JE Krebs, B Lewin, ES Goldstein and ST Kilpatrick (2014) Lewin's Genes XI. Johnes and Bartlett publishers, USA.
2. JD Watson, TA Baker, SP Bell, A Gann, M Levine and R Losick (2013) Molecular Biology of the Gene (7th edition), Benjamin Cummings, USA.
3. RF Weaver (2011) Molecular Biology (5th edition). McGraw-Hill, NY, USA

Teaching Panel: Dr. T. Chathuranga Bamunuarachchige (email: heroiraj@gmail.com, Tel: 0718096400)
Mr. Gayan D. Abeysinghe (email: gayandak1@gmail.com, Tel: 071-5601760)

Course Coordinator: Dr. T. Chathuranga Bamunuarachchige

Course Name: Ecotourism

Course Code: BIO 3102(Theory 12hrs, Field. 08 hrs, IL 20hrs)

Course Capsule: Introduction to fundamental concepts in tourism, Introduction to Ecotourism, Ecotourists, Ecotourism Environments, The Ecotourism Business, Socio-economics of Ecotourism, Ecotourism Development Planning, and Community based sustainable tourism

Course Aim: Introduce students to the key concepts, principles, marketing, planning and management of ecotourism activities and development which promote cultural and environmental awareness and local economic benefits.

Course ILOs: At the end of the course, the student should be able to

1. explain the fundamental concepts and framework of ecotourism
2. discuss the importance of the local ecology, culture, history and economic development balanced with a social responsibility.
3. identify ecotourism markets and develop tailor made ecotourism business strategies for target markets
4. recognize the need for conserving natural resources and maintaining the integrity of the indigenous culture in ecotourism development
5. evaluate the feasibility of potential ecotourism projects, knowledge of tour planning, and site development

Resource Requirements: Handouts, Multimedia, computers, lecture theatres

Transport Requirements: Field visit to a pre-identified nature based ecotourism destination

Assessment Strategy:

Continuous assessments		-35%
Assignment on Ecotourism Planning	-20%	
Quizzes	-10%	
Class Participation	-05%	
End of semester written exam		-65%

References:

1. D Weaver (2005) Ecotourism. John Wiley & Sons, Australia.
2. Weaver, D (2007) Sustainable Tourism, Routledg, NY
3. D Fennell (2014) Ecotourism, 4thed. Routledge, NY.

Other supplementary readings (research articles) will be provided in class

Teaching Panel: Dr. Rajnish Vandercone (Email: vandercone@gmail.com)
Dr. Sriyani Wickramasinghe (Email: sriwick@gmail.com)

Course Coordinator: Dr. Rajnish Vandercone

Course Name: Environmental Pollution

Course Code: BIO 3203 (Theory 25 hrs, Pract. 15 hrs, IL 40 hrs)

Course Capsule: **Introduction:** Increase in population, production and consumption; **Air Pollution,** Introduction, Meteorology and climatology, Industrial emissions, Motor vehicle emissions, photochemical smog; Environmental effects due to air pollution (global and local levels) **Noise Pollution; Water Pollution:** Introduction; Municipal, Industrial and commercial; **Agricultural Pollution;** Agro chemicals**; Solid waste;** Solid waste characteristics and quantities, Composition and generation, collections and landfills, Composting, Combustion and energy recovery; **Hazardous Waste Pollution;** Toxicity, Reactivity, Infectiousness**,** Bio concentration, **Energy and the Environment;** Types of energy sources (Natural and Anthropogenic) **Mitigatory Measures;** Biochemical process**,** Waste minimizing, exchange and recycling **Economic and Legal questions; Environmental Action** (National and International levels).

Course Aim: The aim of this course is to provide the students with the understanding of the key environmental issues and of the current methods and options used to control environmental pollution caused to land, water and atmosphere. In addition, the legislative framework for pollution control in Sri Lanka is also emphasized. Finally students will be equipped with the knowledge to resolve environmental pollution problems, through the selection and application of appropriate control and remediation technologies.

Course ILOs: At the end of the course, the students should be able to

1. identify the sources of air, water, light, noise pollution and solid waste dumping
2. recognize the effects of these pollutants on the environment and human health

3. identify the causes of global warming, ozone depletion; enhanced N and S emissions and urban air pollution
4. describe the feasibility and limitations of a range of strategies/practices for pollution control and remediation of polluted systems
5. examine the legal measures which are used to control or minimize the pollution
6. develop written communication, quantitative and independent research skills
7. draw on a range of sources to assist making judgments and will be aware of a selection of the principal and specialized skills employed in this field
8. use, interpret and evaluate numerical and graphical data relevant to environmental pollution

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres, LMS in RUSL

Transport Requirements: Two field visits outside the University and one field visit to the industry

Assessment Strategy:

Continuous assessment		- 40%
Mid- semester	-10%	
Presentations	- 10%	
Essay	- 20%	
End semester assessment		- 60 %

References:

1. HP Blaschek , CE Thaddeus and S. Jürgen (2012). Solid waste management (principles and practice). Springer Berlin Heidelberg. ISBN; 978-3-642-28680-3
2. MK Hill (2010). Understanding environmental pollution. Cambridge University Press, 3rd ed.
3. DA Vallero (2007) Fundamentals of air pollution. Academic press, ISBN 978-0-12-373615-4
4. PD Abel (2005) Water pollution biology, Second Edition, ISBN 9781482295368
5. http://www.unep.org/urban_environment/PDFs/DandoraWasteDump-ReportSummary.pdf
6. download.nos.org/333courseE/10

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)
Mrs. Neelamani Yapa (email: pnyapa40@yahoo.co.uk, Tel: 0718265938)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: **Bioinformatics**

Course Code: **BIO 3204** (Theory 17 hrs, Pract. 23 hrs, IL 40 hrs)

Course Capsule: Introduction to bioinformatics, Molecular databases, Bioinformatics and computational biology software and freeware, Sequence alignment, Phylogenetic analysis, Functional genomics, DNA microarrays, Protein structure analysis and modeling, Motif identification, Evolutionary alignments and structure prediction.

Course Aim: To provide students from a broad range of backgrounds with an introduction to bioinformatics, an emerging discipline with which we make discoveries in molecular bioscience. This aims to develop both theoretical and practical skills in bioinformatics, with emphasis on the extraction and analysis of data hence equipping students with a working knowledge of computing methodology relevant to the biosciences. The course will prepare students for more advanced courses in the area of bioinformatics, genomics and systems biology.

Course ILOs: At the end of the course, the student should be able to

1. describe the concept of bioinformatics and systems biology
2. outline the significance of online, sequence and molecular biological databases
3. analyze sequence alignments
4. test and critique properties of DNA and protein sequences
5. interpret the importance of molecular phylogeny and compare the optimality criteria of phylogenetic tree generation
6. compare and identify different structures of proteins
7. model structure of a protein using homology modeling
8. appraise the role of modeling in understanding biological systems
9. construct networks and interpret them
10. analyze a microarray data set

Resource Requirements: Computational resources with an uninterrupted internet connection, Handouts, Multimedia projector, lecture theatre.

Assessment Strategy:

Continuous assessments		-30%
	Quizzes	-20%
	Presentations	-10%
End semester examination		-70%
	Theory	-40%
	Practicals	-30%

References:

1. AM Lesk (2014) Introduction to Bioinformatics, 4th ed. Oxford University Press.
2. JM Claverie and C Notredame (2007) Bioinformatics for dummies, 2nd ed. Wiley Publishing, Hoboken NJ.
3. A Baxevanis (1998) Bioinformatics: A practical guide to analysis of genes and proteins, John Wiley.
4. PJ Wiley-Liss, (2009) Bioinformatics and Functional Genomics 2nd ed. ISBN# 978-0-470-08585-1

Teaching Panel: Dr. T. Chathuranga Bamunuarachchige (email: heroiraj@gmail.com, Tel: 0718096400)
Dr. K. D. Ukuwela (email: kanishkauku@gmail.com, Tel: 077-6767379)
Mr. Gayan D. Abeysinghe (email: gayandak1@gmail.com, Tel: 071-5601760)

Course Coordinator: Mr. Gayan D. Abeysinghe

Course Name: Ecotoxicology

Course Code: BIO 3205 (Theory 25 hrs, Pract. 15 hrs, IL 40 hrs)

Course Capsule: Introduction, history and terminology. Sources and different categories of toxins & toxicants (*Gaseous compounds, Heavy metals, Detergents and pesticides, Oils and hydrocarbons, Organometallic compounds, POPs, Bio-toxins*). Exposure routes, uptake, and Elimination of toxicants. Transport and environmental fate of toxicants with particular emphasis on Bioavailability, Bioaccessibility, Bioaccumulation, Bioconcentration, Biomagnification, and Biotransformation, Mammalian toxicity tests and Standard Ecotoxicity testing methods. Factors affecting the toxicity, Hazard & Risk assessments, Environmental toxicology of engineered nano materials. Evaluation of acute and chronic toxicity, bioassays and biomarkers; Radiation and health risks

Course Aim: To give a knowledge and understanding of how chemicals in the environment interact with biotic and abiotic factors to affect individuals, populations, communities, and ecosystems and to be appreciative and critical in practising risk assessments as a measure to minimize the toxic effects of chemicals

Course ILOs: At the end of the course, the student should be able to

1. describe different categories of toxic chemical in the environment, and their sources
2. retrieve and critically evaluate toxic effects of different categories of toxins and toxicants on different biological organizational levels (from databases, hand books, scientific articles)
3. present and explain the environmental fate and transport of chemical pollutants in the environment
4. independently carryout, toxicity tests and compare the toxicities of different toxicants and toxins
5. Independently carry out, environmental risk assessment of chemicals

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: No field visits outside the University

Assessment Strategy:

Continuous assessment		- 50%
	Essays / Assignments	- 20%,
	Mid- semester and class test	- 10%
	Presentations	- 20%
End semester assessment		- 50 %

References:

1. CH Walker, RM Sibly, SP Hopkin and DB Peakall (2012) Principles of Ecotoxicology 4th ed. CRC Press
2. MC Newman (2014) Fundamentals of Ecotoxicology: The Science of Pollution 4th ed.CRC Press
3. PP Calow (1997) Handbook of Ecotoxicology: Wiley-Blackwell

Teaching Panel: Prof. L.P. Jayatissa (email: lpj@bot.ruh.ac.lk)
Prof. Mangala de Silva

Course Coordinator: Prof. Sanath Hettiarachi

Course : **Experimental Design and Nonparametric Methods in Statistics**

Course Code: **BIO 3206** (Theory 20 hrs, Pract. 20 hrs, IL 40 hrs)

Course Capsule: Introduction to experimental design, Experimental study,Observational study, Experimental design phase, Statistical analysis phase, Terms and concepts in designs of experiment, Basic concepts, Comparing two means, Randomized block designs (Paired Designs), Two Factor Experiments, Multivariate Data Analysis Techniques

Course Aim: The objective of this course is to develop the students' ability to design an experiment minimizing errors and analyse the problem appropriate statistical technique.

Course ILOs: At the end of the course, the student should be able to

1. Explain the basic concepts in design of experiment.
    i. Design and analyze simple comparative experiments, single factor experiments and two factor experiments
2. Identify the mathematical model for each design
3. Use computer software to solve the practical problems
4. Explain what multivariate analysis is and when its application is appropriate
5. Determine which multivariate technique is appropriate for a specific research problem.

Resource Requirements: Temporary academic staff member, lecture room setting, sufficient number of computers with statistical software need to be made available to students.

Transport Requirements: No field visits outside the University

Assessment Strategy:

End semester theory examination (ESTE) -	50%
End semester practical examination (USPE)-	20%
Mid semester theory examination (MSTE)-	30%

References:

1. Experimental Design and DataAnalysis for Biologists Gerry P. Quinn, Michael J. Keough
2. A First course in Design and Analysis of Experiments. Gary W. Oehlert.
3. Introduction to Statistics & Data Analysis, Roxy Peck, Chris Olsen, Jay Devore Biostatistical Analysis, Jerrold H. Zar
4. Introduction to Probability and Statistics, J. Susan Milton, Jesse C. Arnold.

Teaching Panel: Dr. Rajnish P. Vandercone (email: vandercone@gmail.com)
Dr. W.H.A.P. Guruge

Course Coordinator: Dr. Rajnish P. Vandercone

Course Name: **Concepts of Biodiversity Conservation**

Course Code: **BDC 3301** (Theory 32 hrs, Pract. 39 hrs, IL 49 hrs)

Course Capsule: Biodiversity and conservation: Introduction and overview of biodiversity. Systematics & Biodiversity: Genetic Diversity, its measure and its modifications, Species concepts; Biogeography: Zoogeography and phytogeography, Species loss and extinction, Theory of Island biogeography on species extinction, Species inventory & its measures. Habitats and ecosystems: Global habitat classification, Uses and values of Biodiversity: Plant use, Animal use, Environmental and economic valuation methods of biodiversity. Threats and loss of Biodiversity: Invasive species and Threatened species. Conservation and Management of Biodiversity: Biological conservation in context; Reasons for conservation, conservation education. Conservation in practice; Ex-situ and In-situ conservation: Ex-situ centers for fauna & flora conservation, Conservation of rare and endanger animals, Captive breeding and success story on reintroduction.

Course Aim: The aim of this course is to introduce student to the scientific study of biodiversity. Students will gain a thorough knowledge on the various concepts of biodiversity, the processes generating and maintaining diversity, and the issues surrounding the conservation of biodiversity for the future. Further, students will be equipped with the knowledge on biodiversity conservation and legislative framework. Finally the course will introduce students to the complexity of biodiversity conservation research and how research can be applied to conservation goals.

Course ILOs: At the end of the course, the students should be able to:

1. identify the existing conservation practices in Sri Lanka and develop a sound knowledge of the concepts of biodiversity
2. relate biogeographic principles to applied biodiversity conservation
3. apply the concept of ecosystem services, link variation in biodiversity to ecosystem services
4. describe factors influencing ecosystem change and species decline
5. distinguish between direct and indirect values of biodiversity and implement techniques for the valuation of biodiversity.
6. evaluate biological and other processes leading to the generation, loss of biodiversity and determine the past and present species extinction and their mechanism s
7. apply environmental education knowledge towards conservation practices
8. apply management principles and tools that are used to conserve biodiversity
9. determine some of the practical methods available for conserving rare and endangered species
10. conduct field-based biodiversity assessments and present information clearly and fluently in both written and spoken forms

Resource Requirements: Handouts, Multimedia, computers, lecture theatres, White board, Field equipment, LMS RUSL,

Transport Requirements: Three field visits outside the University

Assessment Strategy:

Continuous assessment		-25%
Mid- semester	-10%	
Quizzes	-05%	
Group presentations	-10%	
Field component: evaluate field report		-25%
End semester assessment		-50 %

References:

1. MJ Jeffries (2006) Biodiversity & Conservation. Routledge publisher.
2. KJ Gaston and JI Spicer (2013) Biodiversity. Wiley publisher. ISBN: 118684915, 9781118684917
3. MJ Novacek (2001) The Biodiversity Crisis: Losing What Counts. American Museum of Natural History
4. R Pellens and P Grandcolas (2014. Biodiversity Conservation and Phylogenetic Systematics; Species Protection in an Extinction Crisis. Springer International Publishing.

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)
Dr. Rajnish P.G. Vandercone (email: vandercone@gmail.com, Tel: 0775615222)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: **Environmental Impact and Risk Assessment**

Course Code: **BDC 3202** (Theory 20 hrs, Pract. 30 hrs, IL 30 hrs)

Course Capsule: Environmental Impact Assessment (EIA): An introduction to EIA, Legal and Institutional background, EIA process, methodologies for assessing Impacts, Quantification of environmental impacts techniques of valuing environmental impacts; Assessment of environmental impacts (cost – benefit analysis),Public participation in environmental performance reviews and the managerial response. Risk and uncertainty in EIA: The nature of uncertainty, Risk Assessment; Hazards identification, & accounting, Risk characterization & management, Human Risk Assessment, Comparative risk assessment, Ecological Risk Assessment and Risk to economic welfare.

Course Aim: To introduce students to environmental impact assessment. These concepts include understanding how laws work, quantitative and qualitative reasoning, interpreting graphs and tables, critical thinking, and reading. Student will be able to get a clear picture on the process of decision -making by identifying the potentially significant environmental effects and environmental risks of development proposals. Students will learn how EIA will promote sustainable development by ensuring that development proposals do not undermine critical resource and ecological functions or the well-being, lifestyle and livelihood of the communities and peoples who depend on them. Further provide an overview of risk assessment in the decision-making process. Also students will learn to perform all steps of a human health risk assessment and will gain hands-on experience in applying available tools.

Course ILOs: After completion of this course students will be able to

1. identify EIA as one of a suite of environmental management tools & recognize the different steps within the environmental impact assessment process
2. access, and apply evaluation criteria to environmental impact statements
3. identify the alternatives for relevant to the selected proposed projects
4. comprehend the limitations of the EIA process in addressing environmental impacts
5. determine how to liaise with and the importance of stakeholders in the EIA process
6. recognize the role of risk analysis methods with proper communication
7. examine the different case studies/examples of EIA in practice & inspect the ways of monitoring of these project
8. apply the theory for preparation of EIA document with risk assessment methods to minimize health and ecological environmental degradation.
9. Build up team work and improve the writing abilities

Resource Requirements: Handouts, Multimedia, computers, White boards, lecture theatres, equipments

Transport Requirements: Two field visits outside the University

Assessment Strategy:

Continuous assessment		-50%
Evaluation of field work	-15%	
Quiz	-0 5%,	
Presentations	-10%	
Reports	-20%	
End semester examination		-50 %

References:

1. PFH Ogola (2007) Environmental Impact Assessment General Procedure. United Nations University. 23-27
2. A Gilpin (2012) Environmental Impact Assessment (Cutting Edge for the 21st Century). Cambridge University Press. ISBN-9780521429672
3. European Commission (2001) Guidance on EIA, scoping, www.europa.eu.int/comm/environment/eia/ eia-support.htm
4. CEA (1993) National Environmental Act
5. Á Gormley, S Pollard and S Rocks (2011).Guidelines for Environmental Risk Assessment and Management. Cranfield University.
6. DM Kammen and DM Hassenzahl (1999) Should we Risk It? Exploring Environment, Health, and Technological Problem Solving, Princeton University Press, ISBN 0691004269.
7. RE Hester and RM Harrison (1998) Risk Assessment and Risk Management. Royal Society of Chemistry, ISBN 0854042407

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)
Mr. Leel Randeni (email: leelr2001@yahoo.comTel: 0718426244)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: Introduction to Geographic Information System

Course Code: BDC 3203 (Theory 20 hrs, Pract. 22 hrs, IL 38 hrs)

Course Capsule: **Introduction**: Overview, History and Concepts of GIS, Scope and Application Areas, Purpose and Benefits of GIS. Functional Elements of GIS, **Mapping Concept:** Map concept - Map elements, Map scales and representation, Map Projection - coordinate system, datum, and projection systems, Geometric Rectification. **Data Structure:** Raster Data Structure, Vector Data Structure, Data Compression Techniques. **Data Acquisition:** Analogue to digital conversion, Accuracy of digitization. Data from Remote Sensing Imagery, Global Positioning System (GPS) based data acquisition. **Data Manipulation and Analysis:** Data Manipulation Techniques, Spatial Analysis Techniques - statistical and geometrical, Geoprocessing Techniques, Model Development. **Spatial Accuracy Assessment:** Data Quality, Accuracy Assessment using Statistical Tests. **Map Output Generation:** Layout of Maps, Intelligent Maps, Charting and Tabular representation of the results using GIS

Course aim: This module aims to develop the fundamental practical and conceptual skills necessary to undertake simple GIS analysis, and the theoretical and practical competency necessary to study GIS at a higher level. It aims to introduce the student to commercially available software, instruct students in the use of this software in applied GIS analysis scenarios and ensures a solid theoretical and conceptual foundation in GIS fundamental methods and analyses.

Course ILOs: At the end of the course, the students should be able to

1. identify geographic data, Query a GIS database and Edit geographic data
2. determine he GIS industry and functional components of GIS
3. identify GIS applications, users, and their data analysis requirements
4. determine raster and vector data models and the advantages and disadvantages of each
5. develop map scale, coordinate systems, and projections
6. apply with the theoretical and practical knowledge of the ArcGIS 9.2
7. create maps, reports, and graphs for variable data
8. apply data acquisition technologies for capturing GIS data

Resource Requirements: Handouts, Multimedia, computers, lecture theatres, Arc GIS software, GPS, Topography sheets

Transport Requirements: Practicals outside the University

Assessment Strategy:

Continuous assessment		- 40%
	Class test	-xx%
	Practicals	-xx%
	Mini project	-xx%
End semester assessment		- 60 %

Reference

1. DWSW Jay Lee (2005) Statistical analysis with Arc View GIS: John Wiley and Sons, Inc., New York.
2. PA Burrough and RA McDonnell (1998) Principles of geographical Information systems, Oxford University Press.
3. J Star and J Estes (1990) Geographic Information Systems: An Introduction: Prentice Hall, Englewood

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: **Wildlife Conservation and Management**

Course Code: **BDC 3204** (Theory 28 hrs, Pract. 06 hrs, IL 46 hrs)

Course Capsule: Goals and management decisions**,** Food and nutritional ecology, Behaviour and the dynamics of populations and communities, Population growth, Dispersal, dispersion and distribution, Population regulation, Fluctuation and competition between species, Facilitation between species, Predation, Parasites and pathogens, Consumer resource dynamics, Population census techniques, Model evaluation and adaptive management, Experimental management, Conservation theory (Demographic problems contributing to extinction risk, Genetic characteristics of individuals and genetic problems contributing to extinction risk, Effective population size , Population viability analysis, Environmental change and extinction risk), Conservation in practice (How populations go extinct, How to prevent extinction, Rescue & recovery of near extinctions, Conservation in national parks and reserves), Wildlife harvesting, Wildlife control, Ecosystem management and conservation.

Course Aim: To equip students with knowledge of basic wildlife ecology and skills in analyzing problems associated with wildlife with the view of enhancing sound conservation and management of wildlife, develop the ability of students to read and understand primary scientific literature**,** instill the belief that the course can help develop valuable transferable skills (TS) such as writing, develop attitudes such as initiative (IN), responsiveness (RS), lifelong learning (LL) and cooperative learning (CL)in students.

Course ILOs: At the end of the course, students should be able to

1. Demonstrate broad knowledge of how key ecological concepts can be applied to the conservation and management of wildlife
2. Identify methods used to evaluate the conservation status of populations
3. Interpret output from the methods used to evaluate the conservation status of populations and make recommendations
4. Read and understand the primary scientific literature on wildlife conservation and management
5. Describe population census methods
6. Describe methods used to determine body condition in mammals

Resource Requirements: computers with the relevant software, a video camera and 15-20 pairs of binoculars

Transport Requirements: A vehicle to transport students to and within a national park

Assessment Strategy:

Continuous assessment		-40%
Field report	-15%	
Tutorials (05)	-25%	
End semester examination		-60%

References:

1. JM Fryxell, AR Sinclair, G Caughley (2014) Wildlife Ecology, Conservation, and Management. Wiley-Blackwell, Oxford.

Teaching Panel: Dr. Rajnish P Vandercone (vandercone@gmail.com)
Dr. Sriyani Wickramasinghe (sriwick@gmail.com)

Course Coordinator: Dr. Rajnish P Vandercone

Course Name: **Fisheries and Aquaculture**

Course Code: **ZOO 3204** (Theory 25 hrs, Pract. 15 hrs (Lab 10 hrs, Field visit 10 hrs), IL 40 hrs)

Course Capsule: **Fisheries -** World fisheries; Regulation of International and national fisheries; Fisheries legislation, prohibited and restricted fish species for exportation; Fishing gear and crafts; Marine fisheries - costal, inshore and offshore fisheries, pelagic and demersal fisheries; Potential of Brackish water fisheries; Inland fisheries – riverine fisheries, reservoir fisheries; Basic principles of fisheries management. **Aquaculture:** History of world aquaculture and status of aquaculture in Sri Lanka; Site selection criteria for aquaculture; Production methods and systems; Water quality management; Culture of Fin fish and Shell fish; Fish nutrition and health management; Basic principles in preservation and processing of fish and fishery products.

Course Aim: To teach characteristics and management of different types of fisheries in the world and in Sri Lanka, and aquaculture of fish and shellfish and principles of fish preservation and processing.

Course ILOs: At the end of the course, the student should be able to

1. discuss the status of world's fisheries and recent trends and potential of fisheries in Sri Lanka
2. identify different fishing gear and describe the methods of fishing
3. discuss the different aspects of marine, brackish water and freshwater fisheries
4. identify common marine, brackish water and freshwater food fish (Shell fish & fin fish) of Sri Lanka
5. describe the basic principles, regulations and management of fisheries
6. discuss the history and present status of world aquaculture, status of aquaculture in Sri Lanka and principles role, and scope of aquaculture
7. explain the principles of site selection for aquaculture
8. assess the water quality of the water to be used in ponds
9. describe the production methods and systems in aquaculture
10. culture of fin fish and shell fish for food

11. discuss principles of fish nutrition
12. prepare fish feeds
13. explain fish health management in aquaculture
14. describe the basic principles of postharvest technology

Resource Requirements: Handouts, multimedia, computers, live specimens, posters, laboratories, lecture theatres

Transport Requirements: Bus for field visits

Assessment Strategy:

Continues assessment		-50%
Quizzes/ report	-10%	
Mid semester	-20%	
Presentations	-20%	
End semester (Theory)		-50%

References:

1. TJ Pitcher and PJB Hart (1982) Fisheries Ecology, Croom Helm, London.
2. G Post (1987) Textbook of Fish Health, TFH Publications, Oxford, London.
3. CJ Shepherd and NR Bromage (1992) Intensive Fish Farming, Blackwell Science, Oxford.
4. M King (1995) Fisheries Biology, Assessment and Management, Fishing News Books, Oxford.
5. NR Bromage and RJ Roberts (1995) Brood stock Management and Egg and Larval quality. Blackwell Science, Oxford.
6. RL Welcomme (2001) Inland Fisheries: Ecology and Management, Fishing News books, Blackwell Science, Oxford.
7. U Edirisinghe (2009) Freshwater fisheries and Aquaculture of Sri Lanka, Kandy printers
8. S Mustafa and R Shapawi (2015) Aquaculture Ecosystems: Adaptability and Sustainability. Wiley- Blackwell.
9. JF Craig (2015) Freshwater Fisheries Ecology. Wiley- Blackwell.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email:tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: Breeding Techniques in Aquaculture

Course Code: **FAM 3302** (Theory 30 hrs, Pract. 45 hrs (Field visit 05 hrs, Training 40 hrs), IL 45 hrs)

Course Capsule: Natural spawning of fish; Brood stock selection and management; Controlled spawning of finfish, crustaceans and mollusks; Natural spawning; Conditioning; Induction of breeding – semi artificial & artificial; Collection and incubation of eggs.

Course Aim: To teach the skills in breeding of selected fin fish and shell fish species in aquaculture.

Course ILOs: At the end of the course, the student should be able to

1. discuss the role of hormones in fish reproduction

2. describe the different breeding techniques used in aquaculture
3. explain the principles of induced spawning
4. describe artificial fertilization, incubation and larval raring
5. describe preservation of fish sperms
6. assess the maturity of brood stock and manage the brood stock
7. perform induced spawning of selected fin fish and shrimps
8. describe induced spawning of selected echinoderms and bivalves
9. explain transport of brood stock and larval fish
10. explain the genetic improvements in aquaculture

Resource Requirements: Handouts, multimedia, computers, live specimens, posters, laboratories, lecture theatres

Transport Requirements: For field visit and training program

Assessment Strategy:

Continues assessment		-50%
Quizzes/ report	-10%	
Mid semester	-20%	
Presentations	-20%	
End semester (Theory)		-50%

References:

1. NR Bromageand RJ Roberts (1995) Brood Stock Management and Egg and Larval Quality, Blackwell Science, Oxford
2. JE Thorpe, GA Gall, JE Lannan and CE Nash (1995) Conservation of fish and shellfish resources: Managing diversity. Elsevier.
3. AD Rex (2004) Aquaculture and Fisheries Biotechnology: Genetic Approaches, CABI
4. C Conand (2004) Advances in sea cucumber aquaculture and management(No. 463). Food & Agriculture Org.
5. G Trygve (2005) Selection and Breeding programs in Aquaculture. Springer Science & Business Media.
6. Å Akvaforsk (2005) Selection and breeding programs in aquaculture (p. 364). T Gjedrem (Ed.). Dordrecht: Springer.
7. G Trygve and B Matthew (2010) Selective breeding in Aquaculture– An Introduction. Springer Science& Business Media
8. T Gjedrem and M Baranski (2010) Selective Breeding in Aquaculture: an Introduction: An Introduction (Vol. 10). Springer Science & Business Media.
9. JS Lucas and PC Southgate (2012) Aquaculture: Farming aquatic animals and plants. John Wiley & Sons.
10. CPB Meske and F Vogt (2014) Fish aquaculture: technology and experiments. Elsevier.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email: tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: **Ornamental Fisheries Industry**

Course Code: **FAM 3303** (Theory 30 hrs, Pract. 40 hrs (Field visit 10 hrs, Training 30 hrs), IL 50 hrs)

Course Capsule: Status of world ornamental fisheries; Constraints and problems in ornamental fisheries sector; Identification of important ornamental fish varieties – freshwater and marine; Breeding of ornamental fish; Selection and management of brood stock; Stock improvement; Use of biotechnology in stock improvement; Producing hybrids; Breeding methods of different species; Nursery management; Mud pond preparation; Stocking and harvesting; Pond Management; Important water quality parameters; establishment and maintenance of aquaria, setting up of an aquarium (including construction of tanks, filter systems etc.) Harvesting, packing and transportation; Legislation including quarantine, wild catch, export etc.

Course Aim: To teach the status of ornamental fisheries sector in the world and Sri Lanka, characteristics of common ornamental fish, their breeding and culture, packing and exportation.

Course ILOs: At the end of the course the student should be able to

1. explain the status of ornamental fisheries sector in the world and Sri Lanka
2. Discuss problems and constraints in ornamental fisheries sector and strategies for the future development of ornamental fisheries sector in Sri Lanka
3. Identify the different freshwater and marine ornamental fish species
4. describe the breeding of freshwater ornamental fish
5. Explain the establishment and maintenance of an aquarium
6. describe the setting up of an aquarium
7. discuss the shipping practices of ornamental fish

Resource Requirements: Handouts, multimedia, computers, live specimens, posters, laboratories, lecture theatres

Transport Requirements: For field visit and training program

Assessment Strategy:

Continues assessment	-50%
Quizzes/report)	-10%
Mid semester	- 20%
Presentations	-20%
End semester (Theory)	- 50%

References:

D Mills (1988) Popular Guide in Tropical Aquarium Fishes. Salamander Books Ltd., London.

R Pethiyagoda (1991) Freshwater Fishes of Sri Lanka, Wildlife Heritage trust, Colombo

JD Van Ramshorst (1995) The complete Aquarium encyclopedia of tropical freshwater fish, Elsvier, UK.

D Mills (1987) The practical encyclopedia of the marine aquarium. Salamander Books, London.

J Dawes (1991) Live bearing fish: a guide to their aquarium care, biology and classification. Blanford Book, London.

P Hiscock (2003) Aquarium displays inspired by nature. Interpet Publishing, England.

P Hiscock (2003) Encyclopedia of aquarium plants. Barrons Education, New York.

D Mills (2005) The complete aquarium guide: fish, plants and accessories for your aquarium. SolvakiaKonemann.

A Verma and A Singh (2013) Animal Biotechnology: Models in Discovery and Translation. Academic Press.

JS Lucas and PC Southgate (2012) Aquaculture: Farming aquatic animals and plants. John Wiley & Sons.

Teaching Panel: Dr (Mrs.) TV Sundarabarathy (Email:tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) TV Sundarabarathy

Course Name: Industrial microbiology

Course Code: **MIB 3201**(Theory 23 hrs, Pract. 21 hrs, IL 36 hrs)

Course Capsule: Microbial growth processes and kinetics, fermentation technology- bioreactor/ fermentor design, upstream and downstream processing, solid surface fermentation, substrate utilization, process economics, high-throughput screening and process optimization, microbial product development, regulation and safety, enzymes biotechnology, biotransformation, Introduction to industrial processes, biofertilizers, bioherbicides and biopesticides production and applications, biofuels and industrial chemicals - ethanol, amino acids, microbial polysaccherides, single cell oils, health care products- antibiotics, vaccines, vitamins, production of steroid hormones, vinegar production, biomass production, environmental applications - microbial analysis of water, water treatment processes, treatment of ground water, waste water treatment, solid waste compost production, soil remediation processes, bioleaching an biooxidation, biosorbants and heavy metal bioabsorption, biomining, biosurfactants, biopolymers and bioplastics production, biosensors and applications.

Course Aim: To teach important aspects of industrial microbiology so that students would appreciate the commercial exploitation of microorganisms in processes of major economic, environmental and social importance, promote excellence among students of industrial microbiology and enhance their intellectual development and career opportunities.

Course ILOs: At the end of the course the student should be able to

1. describe the diversity of microorganisms and their metabolic capabilities to produce an extensive array of products
2. explain bioprocessing which involves commercial fermentation operations and requirements for large-scale cultivation of microorganisms, microbial process kinetics, bioreactor/ fermentor design and downstream processing
3. decide the appropriate techniques in bioprocessing with respect to the desired end product

4. produce the desired microorganism containing a product on an industrial scale, including the choice of carbon source and other nutrients and the factors that influence this
5. produce biofertilizers,biopesticides and bioherbicidesat laboratory scale and design techniques for commercial production
6. design small scale compost production facility
7. explain the application of microorganisms to environmental biotechnology that includes water treatment, treatment of solid waste and bioremediation.
8. identify community concerns and solve problems through the application of microorganisms at a local as well as an industrial level
9. identify research fields in modern industrial microbiology

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: A bus to go to Colombo and Awissawella

Assessment Strategy:

Continuous assessment		-50%
Reports	- 05%,	
Presentations	- 10%	
Group discussions	- 05%	
Practical skills evaluation	- 20%	
Class test (theory)	- 10%	
End semester theory examination		- 50 %

Practical component will be assessed continuously in the class work

References:

1. JG Black (2005) Microbiology, Principles and explorations, 6thed.John Wiley & Sons Inc.
2. MJ Waites, LM Neil, JS Rockey and G Higton (2001) Industrial Microbiology: An Introduction. Wiley-Blackwell scientific 304pp.
3. B McNeil and LM Harvey (2008) Practical Fermentation Technology. John Wiley & Sons, Ltd.

Primary reading materials will consist of current review journal articles.

Teaching Panel: Mrs. P. Neelamani Yapa (pnyapa40@yahoo.co.uk)
Dr. T.C. Bamunuarachchige (email: heroiraj@gmail.com, Tel: 0718096400)

Course Coordinator: Mrs**.** P. Neelamani Yapa

Course Name: Soil Microbiology

Course Code: MIB 3202 (Theory 24 hrs, Pract. 16 hrs, IL 40 hrs)

Course Capsule: Introduction, soil microbial community, soil as a special habitat, soil microbial diversity and interactions, soil microbial communities (colonization, succession, microbiostasis), survival strategies of microorganisms, quantitative microbial ecology, substrate for colonization, disease suppressive and permissive soils, overview of rhizosphere as a special soil environment, soil microorganisms and plant health and

productivity, microbial inoculations of soil, modern methods of assessment of microbiota in soil

Course Aim: To view soil as a complex microbial habitat in order to learn microbial diversity, their interactions, methods used for studying microorganism and their interaction and to be appreciative and critical in applications of microorganisms in natural environments

Course ILOs: At the end of the course, the student should be able to

1. explain the unique features of soil as a habitat for microorganisms
2. describe diversity of soil microorganisms
3. explain limits of methods used in soil microbial ecology
4. relate the properties of microorganisms to their ability to colonize different substrates
5. describe survival strategies of soil microorganisms
6. differentiate between disease suppressive and disease permissive soils
7. discuss the role of soil microorganisms in plant health and productivity
8. analyse the success and failure of microbial inoculations in soil
9. relate the rhizosphere microflora with plant health
10. design appropriate methodology for isolation and characterization of soil microorganisms

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: No field visits outside the University

Assessment Strategy:

Continuous assessment		- 50%
Essays	- 20%,	
Mid- semester and class test	- 10%	
Presentations	- 20%	
End semester assessment		- 50 %

References:

1. JG Cappuccino and N Sherma (2011) Microbiology Laboratory Manual, 4th Edition (579CAP)
2. AP Eldor (2007) Soil Microbiology, Ecology and biochemistry, Third Edition (631.46 SOI)
3. JG Holt, NR Krieg, PHA Sneath, JT Stanley and ST Williams (2000) Bergey's manual of determinative bacteriology. Williams & Wilkins, Baltimore (579.3BER)
4. MS Coyne (1999) Soil microbiology: an exploratory approach (579.1757COY)

Teaching Panel: Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 0771101501)

Course Coordinator: Prof. Sanath Hettiarachi

Course Name: Virology

Course Code: MIB 3203 (Theory 23 hrs, Pract. 15 hrs (Lab 09 hrs + Ind. visit 06 hrs) IL 42 hrs)

Course Capsule: concise – History of virology, Structural components of viruses and their functions, Importance of viruses, Virus classification, Infection cycle emphasizing different mechanisms in replication of viral genome, other subcellular infectious agents, Sequential gene expression in phages, Molecular mechanism of lytic, lysogenic decision, Plant viruses, Retro viruses, Immerging viral diseases.

Course Aim: To impart knowledge in structure, functions and evolution of viruses and other subcellular infectious agents, to appraise importance of viruses as infectious agents and as a tool in genetics and molecular biology and to develop strategies for controlling immerging viral diseases.

Course ILOs: At the end of the course, the student should be able to

1. describe the term virus, viral properties and structural components and their functions
2. evaluate the importance of viruses as infectious agents and also in various applications
3. discuss how viruses are classified based on nucleic acid composition, presence of envelope and shape and possible routes of their evolution
4. describe the architecture of virus
5. discuss the pros and cons of methods of cultivation of viruses
6. describe the stages involved in viral replication, and variations found in different groups of viruses
7. explain the existence and characteristics of non-cellular infectious agents
8. evaluate viral strategies of sequential gene expression
9. propose strategies for control of immerging viral diseases
10. perform isolation and enumeration of bacteriophages from sewage
11. analyze and report the status of research in plant viruses in Sri Lanka and perform a simple artificial inoculation experiment

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: Visit to Plant Virus Indexing Center, Homagama

Assessment Strategy:

Continuous assessment		- 50%
	Essays/ Reports	- 20%
	Practical Skills	- 10%
	Presentations	- 10%
	Mid-semester exam	- 10%
End semester assessment		- 50 %

References:

1. NH Acheson (2011) Fundamentals of molecular virology 2nded. John Wiley
2. JB Carter and VA Saunders (2007) Virology principles and applications. John Wiley, England

3. NJ Dimmock, AJ Easton and KN Leppard (2007) Introduction to Modern Virology 7th Ed. Blackwell

Teaching Panel: Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 0771101501)
Dr. T. Chathuranga Bamunuarachchige (email: heroiraj@gmail.com, Tel: 0718096400)

Course Coordinator: Prof. Sanath Hettiarachi

Course Name: Food Microbiology

Course code: MIB 3204(Theory 23 hrs, Pract. 21 hrs, IL 36 hrs)

Course Capsule: Introduction to food microbiology, dairy microbiology- microbial quality of raw milk, dairy associated fungi and bacteriophage, milk testing, natural antimicrobials in milk, dairy food production- yoghurt, cheese, curd, butter, sour milk etc., probiotics, prebiotics, intrinsic and extrinsic factors affecting microbial growth, microbe-food interactions, Production of fermented foods and food additives, single cell proteins, mushroom production technology, microbial food spoilage, foodborne pathogens, foodborne diseases-infections, intoxications, virus and prions foodborne diseases, biofilm formation, detection of microorganisms and microbial toxins in food – culture based techniques, conventional and rapid methods for the microbiological examination of foods, food preservation methods, food processing, hurdle effect, food canning, food packaging, application of enzymes in the food industry, use of biopreservatives, functional foods and GM foods, food safety, Hazard Analysis Critical Control point (HACCP) plans.

Course Aim: to provide broad insight of the aspects of microbiology and biotechnology of relevance to the food industry, to discuss the topics from traditional food fermentations to the recent developments in the production of functional foods, to make students aware of common microbe-food interactions, both beneficial and deleterious, enable students to appreciate the need for safe procedures in food production and handling chains and to understand risk assessment procedures.

Course ILOs: At the end of the course, the student should be able to

1. relate the metabolic activity of microorganisms to production of a range of foods
2. describe the beneficial role of microorganisms in fermented foods and in food processing
3. critically evaluate the role of probiotics and prebiotics in treating various medical conditions
4. describe the role and significance of intrinsic and extrinsic factors on growth and response of microorganisms in foods
5. utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.
6. relate the nature of microorganisms both to their ability to cause food spoilage and foodborne diseases
7. identify food preservation techniques
8. select and categorize methods for detection and identification of microbes for assessment of food quality and safety

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: A bus to visit Highland milk factory and fruit processing factory in Colombo

Assessment Strategy:

Continuous assessment - 40%

- Reports - 05%,
- Presentations - 10%
- Group discussions - 05%
- Practical skills evaluation - 20%

End semester theory examination - 60 %

Practical skills will be assessed continuously in the class work (no end semester practical exam).

References:

1. B Ray and A Bhunia (2013) Fundamental food microbiology 5th ed.
2. JM Jay, MJ Coessner and DA Golden (2005) Modern food microbiology 7th ed. Springer.

Primary reading materials will consist of current review journal articles.

Teaching Panel: P. Neelamani Yapa (pnyapa40@yahoo.co.uk)

Course Coordinator: P. Neelamani Yapa

Course Name: Plant–Microbe Interactions

Course Code: MIB 3205 (Theory 24 hrs, Pract. 16 hrs, IL 40 hrs)

Course Capsule: Introduction, Rhizosphere microflora, Ecology, genetic diversity and screening strategies of plant growth promoting rhizobacteria (PGPR),Phyllosphere microbes, mutualistic symbiosis: Legume –*Rhizobium* symbiosis, actinorrhizal plant - *Frankia* symbiosis, symbiotic cyanobacteria, Physiological and biochemical processes in nitrogen fixation, Nodulation, genetic and molecular fundamentals of biological nitrogen fixation, Physiology and molecular biology of non-symbiotic nitrogen fixation, Fungal symbiosis-mycorrhizae, biology of mycorrhizal symbiosis in natural and agro-ecosystems, Ecology and genetics of the arbuscular mycorrhizal symbioses, Taxonomy and detection methods of mycorrhizal fungi, Methods and applications of mycorrhization, Microbial inoculants for crop enhancement: analysis of factors in success or failure, In situ observation, isolation and cultivation of plant associated microorganism, In vitro and in vivo techniques of studying plant-microbial interactions, Case studies using recent publications

Course Aim: This course will allow students to reflect on harnessing the beneficial interactions of microorganisms with plants guided by understanding fundamentals of such interactions and factors that should be taken into account in designing a strategy for such action.

Course ILOs: At the end of the course, the student should be able to

1. differentiate rhizosphere microflora from microflora of root-free soils and between rhizosphere bacteria and rhizobacteria
2. discuss beneficial effects of plant associated microorganisms on plant growth,

health and yield improvement

3. explain plant-microbial interactions at molecular level
4. demonstrate practical skills in *in situ* observation, Isolation and cultivating plant associated microorganisms and in performing simple inoculation experiments
5. critically analyze the potential success or failure of microbial inoculants in nature
6. present a case study in plant-microbial interactions to an audience

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements:

Assessment Strategy:

Continuous assessment		-50%
Reports	- 05%,	
Presentations	- 10%	
Group discussions	- 05%	
Practical skills evaluation	- 20%	
Field guide	- 10%	
End semester theory examination		- 50 %

References:

1. SE Smith and DJ Read (1997) Mycorrhizal Symbiosis, 2nd ed. Academic Press, N.Y.
2. A Iqbal, J Pichtel and S Hayat (2008) Plant-bacteria interactions: Strategies and techniques to promote plant growth, Wiley VCH veriag. Gmbh. Co.
3. MBR González, J Gonzalez-López (2013) Beneficial Plant-microbial Interactions: Ecology and Applications. CRC Press
4. DM Sylvia, PG Hartel, Peter and DA Zuberer (2005) Principles and applications of soil microbiology 2nd ed. Pearson, Singapore

Primary reading materials will consist of current review journal articles.

Teaching Panel: Prof. Sanath Hettiarchi (email: Sanath.hetti@gmail.com)
Dr. T.Chathuranga Bamunuarachchige (email: heroiraj@gmail.com)
Mrs. P.N.Yapa (email: pnyapa40@yahoo.co.uk)

Course Coordinator: Dr. T. Chathuranga Bamunuarachchge

Course Name: **Entrepreneurship Development**

Course Code: **IDC 3201** (Theory 30 hrs, IL 50hrs)

Course Capsule: Introduction to business, the challenge of entrepreneurship, developing successful business ideas, feasibility analysis, selecting the form of ownership, building the business plan, creating a solid financial plan, managing cash flow, building a marketing plan.

Course Aim: This program provides students with knowledge on management theories and practices from a number of different perspectives together with specialized knowledge in the field of entrepreneurship. Students learn to integrate strategic, organizational, marketing, and financial information for use in real businesses. The combination of

business theories with practical applications empowers students to become future business leaders.

Course ILOs: At the end of the course the student should be able to

1. define the role of the entrepreneur
2. discuss the issues that entrepreneurs should consider when evaluating different forms of ownership
3. develop successful business ideas and carry out proper feasibility analysis
4. create projected financial statements and understand basic financial statements through ratio analysis
5. explain the importance of cash management to the success of a small business and differentiate between cash and profits
6. describe the components of a business plan including financial and marketing plan and prepare a successful business plan

Resource Requirements: Handouts, Multimedia, computers, lecture theatres,

Transport Requirements: No field visits outside the University

Assessment Strategy:

Continuous assessment		- 40%
	Participation	- 10%,
	Business plan	- 20%
	Presentations	- 10%
End semester assessment		- 60 %

References:

1. T W Zimmerer (2007) Essentials of Entrepreneurship and Small Business Management 5th ed. Prentice Hall.
2. BR Barringer (2011) Entrepreneurship: Successfully Launching New Ventures (4th Edition). 4th ed. Prentice Hall.
3. RL Daft (2014) Understanding Management 9th ed. Cengage Learning.

Teaching Panel: To be identified

Course Coordinator: Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 771101501)

Course Name: **Standards and Quality Management Systems**

Course Code: **IDC 3202** (Theory 27 hours, factory visit 6 hrs, IL 47 hrs)

Course Capsule: Introduction, Evolution of Quality Management Systems, application of Quality Management Systems, Type of Industries, Sri Lankan Food and Beverage industry, Available Quality standards for Sri Lanka food and beverage industry, legal and legislative framework for Local Food Industry, Accreditation process and accreditation bodies, type of audits, Quality Management systems and benefits

Course Aim: To teach applicable and relevant food standards in Sri Lanka and how Quality Management systems are being used to comply with the standards while understanding customer preference for such products and services

Course ILOs: At the end of the course, the student should be able to

1. explain the role of governing bodies of Sri Lankan food industry
2. describe legislative standards applicable to local food and beverage industry
3. discuss the relevance of industry specific standards
4. explain key features of quality management systems and their importance
5. explain the accreditation process and function of accreditation bodies
6. explain the fundamentals/ principals in designing hygienic food processing facility and Good Manufacturing Practices
7. emulate as a quality system auditor in the food industry
8. design audit templates and organize audit itineraries

Resource Requirements: Handouts, Multimedia, computers, lecture theatres

Transport Requirements: Vehicle for field visit

Assessment Strategy:

Continuous assessment		-40%
	Presentations	-10%
	Assignment	-10%
	Field report	-10%
	Case study	-10%
End semester assessment		-60%

Teaching Panel: Mr. N.S. Pathirana (email: nimal.p@cargillsceylon.com Tel: 0777726578)

Course Coordinator: Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com; Tel: 0771101501)

6. HONOURS DEGREE PROGRAMMES

Please refer to the table in pages 04 to 10. The pre-requisite courses for each Honours Degree Programme are listed at the end of this table.

Several courses offered under B.Sc. in Applied Science Degree programme are available for Honours Degree Programmes and *vice versa*.

Courses with Common Formats across Different Honours Degree Programme

Current Topics, In-plant Training, Research Project in each the discipline of study in the three Honours Degree programmes follow the same format. Syllabi of these courses are, hence given below.

Current Topics in Biodiversity Conservation (BDC 4208), in Fisheries and Aquaculture Management (FAM 4208) and in Microbiology (MIB 4208)

Course Name: **Current Topics in Biodiversity Conservation, Fisheries and Aquaculture Management / Microbiology**

Course Code: **BDC 4208/ FAM 4208/ MIB 4208** (IL 100 hrs)

Course Capsule: Reviewing a scientific article in its manuscript stage, Writing a review article in student's own subject area Presentation of a summary of the review

Course aim: To provide students with an insight into some of the most recent advances in his/ her subject area and to develop skills associated with understanding, information retrieval, summarizing and interpretation of knowledge in the relevant field, while inculcating critical analysis, comment, and constructive criticism.

Course ILOs: At the end of the course, the student should be able to

1. search literature and identify key findings in journal articles of a specific advanced topic in a given subject
2. critically analyze and interpret the scientific literature and produce a comprehensive literature review
3. critically appraise research papers
4. write and present a comprehensive account with scientific merit
5. manage time and organize
6. synthesize and plan advanced research of interest

Assessment Strategy:

Review of the research article	-30%
Writing a review article	-30%
Oral presentation of review	-20%
Group discussion	-20%

Teaching Panel: All academic staff of the Department

Course Coordinator: A staff member identified at a Departmental Meeting

In-Plant Training in Biodiversity Conservation (BDC 4209), in Fisheries and Aquaculture Management (FAM 4209) and in Microbiology (MIB 4209)

Course Name: **In-plant Training**

Course Code: **BDC 4209/ FAM 4209 / MIB 4209** (200 hrs)

Course Capsule: Training in a research institute/industry/business venture relevant to the Degree Programme, under a professional supervision; Hands on experience in all aspects in functioning of an organization, Application of knowledge and skills in work place situations, Adherence to protocols, Quality management and standards, Management structure and legal framework of an organization,

Course Aim: To develop appropriate knowledge, skills, attitudes and mind set necessary for 21st Century Graduate by providing students with hands on experience at work place environment, and to inspire them to take challenges of future employment

Course ILOs: At the end of the in plant training, student should be able to

1. report the experience acquired during the training
2. critically analyze the procedures followed in the organization
3. propose remedial measures for deficiencies identified
4. comment on best practices followed in the organization

Resource Requirements: Industry - Institution Liaison Cell

Transport Requirements: None

Assessment Strategy:

Evaluation by coordinator at the organization	-30%
Log book certified by the Coordinator	-20%
Report submitted by the student	-25%
Presentation and discussion	-25%

Teaching Panel: An academic staff member will liaise with an organization
A coordinator appointed by the organization and other staff

Course Coordinator: A staff member identified at a Departmental Meeting

Research Project in Biodiversity Conservation (BDC 4810), in Fisheries and Aquaculture Management (FAM 4810) and in Microbiology (MIB 4810)

Course Name: **Research Project**

Course Code: **BDC 4810/ FAM 4810/ MIB 4810** (800 hrs)

Course Capsule: A research project, totaling to 8 Credits (800 hrs) is assigned to each student under the supervision of a senior academic staff member. The projects can be carried out in the areas of Ecology, Biodiversity, Wildlife conservation, Fisheries Management, Aquaculture, Biotechnology, Molecular biology and Microbiology. Before commencement of the research work, a proposal should be submitted including plan, the methodology of the project and expected outcome and presented at a seminar before a panel of examiners. Progress of the project should be presented in the 10th week of the semester and a report should be submitted to the supervisor. A dissertation should be submitted before the end of the academic year on or before an agreed date by following the given thesis guidelines. Finally the findings of the project should be presented before a panel of examiners.

Course Aim: The aim of this course is to allow students to carry out a short field-based project on a special topic related to the main area of study. Identify a research question after completion of a literature survey on a given research topic. Improve the knowledge on project design, data analysis and interpretation. Further develop the scientific writing and communication skills.

Course ILOs: At the end of the research project, student should be able to

1. identify meaningful research questions
2. demonstrate skills to carry out a research project according to the scientific method
3. recognize sound experimental design, develop statistical analysis of data and interpretation
4. develop scientific writing, communication skills and publishing the results

Resource Requirements: Laboratory space and services, relevant equipment and consumables,

Transport Requirements: Field visits outside the University

Teaching Panel: All the senior academic members in the department

Course Coordinator: A Coordinator for Research projects shall be appointed by the concurrence of the academic staff of the study programme

Assessment Strategy:

Guidelines for Evaluation for Theses/ Dissertations of Undergraduate Research

Following guidelines for undergraduate thesis/ dissertation evaluation shall be followed in the Department of Biological Sciences, Rajarata University of Sri Lanka

Marks should be allocated in four steps. The contribution of marks to the final mark shall be reviewed periodically. A sample of possible marks distribution is given below.

Steps	Assigned for	Mechanism of marking	Marks %
1	Proposal presentation	Average marks of panel of examiners consisting at least 3 members	10
2	First draft of the thesis/ report	Supervisor	20
3	Final version of the thesis/ report	Average marks of two Examiners	50
4	Final project seminar	Average marks of panel of examiners consisting at least 3 members	20
	Total		100

Step 1

Intention of this step is to orient the student in proper direction. This presentation should be done in the presence of all academic staff of the study programme acting as examiners or at least three examiners in addition to the Supervisor/ Supervisors. The aspects considered should include the following.

i. Introduction (research problem, objectives and proposed methodology)
ii. Organization of the research(alignment of methodology with objectives, realistic timeframe)
iii. Relevance of the research (contribution to the scientific knowledge, relevance to national needs, originality of the work)
iv. Quality of presentation (preparation of the presentation, communication skills, confidence)
v. Overall impression (maturity shown, comprehension of the research proposed, taking part in discussion, etc.)

An evaluation sheet structured as above, and approved by the academic members of the Study Programme shall be used in evaluation.

Step 2

The following aspects shall be taken into account by the Supervisor/ Supervisors and marks should be allocated for accordingly. Supervisors' should accompany a brief report justifying the marked allocated for each aspect. When more than one Supervisor has been assigned, the marks should be given independently, and the average mark shall be carried forward.

Write-up	50%
Weight of the research	20%
Student profile	20%
Submission	10%
Total	100%
Final marks calculated for	**20%**

Write-up

Whether the format has been followed, the language usage, the length of the write-up (not inappropriately long or short), the organization and neatness of the write-up, proper use of maps, tables, graphs etc., adequate data analysis and interpretation, matching objectives with conclusions/ discussion, appropriateness of literature cited, use of appendices where necessary, etc. are considered in allocating marks for this section.

Weight of the research

The amount of activities carried out, whether all initial objectives are fulfilled, whether the allocated time has been effectively utilized and similar aspects are considered in evaluation.

Student profile

Concern about
i. attitude
ii. self-confidence
iii. attention to details/ neatness
iv. safety awareness
v. other

Submission

Consider whether student has submitted the first draft with all necessary chapters (abstract, introduction, methodology, results, discussion and reference list), on time or submitted incomplete version

Step 3

Marks should be allocated for write-up only. This step is independent from the Supervisor. A panel of two examiners shall be appointed by consensus of the academics of the study programme.

Average mark given by examiners will be taken forward.

When allocating marks examiners could mainly consider

1. originality of the thesis/ independence
2. clarity of defining objectives
3. understanding methodology
4. use of theoretical /experimental aspects
5. proper analysis of data
6. skill of interpretation
7. neatness/ accuracy/organization/spellings/labeling diagrams and figures
8. etc..

In addition, following criteria shall also be considered

Abstract

Clearly summarizes objectives, methodology, results and output of the study

Introduction

a. Clearly describes extent of the study to be undertaken
b. May include a separate relevant literature review; whichever format this is given should be concise and relevant to the work done
c. Outlines a methodology appropriate to the study

Problem/ Questions

a. The dissertation focuses on a significant and meaningful problem or issue in the field
b. Significance/Importance of the study is well established
c. The anticipated results or methodology of the study have widespread interest, provide a basis for generalized conclusions, or have practical applicability

Related Literature

a. Provides evidence of extensive range of reading
b. Includes a review of the **relevant** literature
c. States explicitly the links between the review and area of study proposed

Methodology

a. The research design clearly states and justifies the use of a specific qualitative or quantitative paradigm.
b. Methodologies derive logically from problem or issue statement.
c. Stages of the methodology are all specified and logically related. The proposal describes fully the methodological procedures to be followed.

Findings

a. The process by which the data is analyzed and interpreted is clearly presented.
b. The analysis logically and sequentially answers all the research questions, or supports or fails to support all hypotheses.

Summary, Conclusions and Recommendations

a. The findings are logically and systematically summarized.
b. Conclusions are derived from all that the data analysis revealed.
c. The recommendations flow logically from the conclusions and are useful.

Overall Writing Style

a. The dissertation is written in scholarly language.
b. Grammar, punctuation, and spelling are correct.
c. The writing is clear, precise and avoids redundancy.
d. There is an accurate use of references.
e. In-text citations are found in the bibliography.

All examiners are requested to submit a report following format to the Head of the Department.

B. Sc. Honuors Degree in Biodiversity Conservation/ Fisheries and Aquaculture Management/ Microbiology
Rajarata University of Sri Lanka

Thesis Assessment - Examiner's Report

Name of the student: (Optional)

Index No:

Thesis Title:
……

The Thesis is;

Excellent ☐ Very Good ☐ Good ☐ Satisfactory ☐ Unsatisfactory ☐
(Please mark "X" in appropriate box.)

Marks allocated:

Name of the Examiner:

Designation:

Affiliation: (If not affiliated to the Faculty of Applied Sciences)

Comments: (Please comment on each aspect in evaluation)

Signature: **Date:**

Step 4

The duration of the presentation should be 15 minutes and followed by 10 minutes of discussion. Students need to convince the audience that 1) He/she understands the topic, 2) has identified the problems and 3) capable of working towards a solution or product. Marks should be allocated for these aspects under the general impression perceived by the examiner. **The marks allocated for this is 60%.**

Marks allocated for following aspects of the presentation is 40% (10% for each aspect)

i. Content/ accuracy/ spelling/
ii. Time management (whether the presentation is organized properly to be presented within time allocation, allocation of time for introduction, methodology, results and discussion)
iii. Skills of presentation (which includes ability to communicate, clarity of description, platform manners, structure of the talk and competence in handling questions)
iv. Comprehension (as judged by presentation and participation in discussion)

An evaluation sheet structured as above, and approved by the academic members of the Study Programme shall be used in evaluation.

B.Sc. in Applied Biology (Biodiversity Conservation) Honours Degree Programme

Third Year

BOT 3201 Plant Tissue Culture, ZOO 3204 Embryology and Developmental Biology, BIO 3201 Molecular Biology, BIO 3102 Ecotourism, BIO 3203 Environmental Pollution, BIO 3205 Ecotoxicology, BIO 3206 Experimental Design and Nonparametric Methods in Statistics, BDC 3301 Concepts of Biodiversity Conservation, BDC 3202 Environmental Impact and Risk Assessment, BDC 3203 Introduction to GIS, BDC 3204 Wildlife Management and Conservation (22 Credits) which are available as optional courses for B.Sc. in Applied Sciences are made compulsory for this study programme.

In addition, ZOO 3201 Medical Entomology, ZOO 3202 Applied Parasitology, BIO 3204 Bioinformatics, IDC 3201 Entrepreneurship Development, IDC 3202, Standards and Quality Management Systems(10 Credits) are also available as optional courses for the students following this Honours Degree Programme.

Fourth Year

Course Name: **Environmental Policies and Management**

Course Code: **BDC 4201 (Theory 24 hrs, Pract. 18 hrs, IL 38 hrs)**

Course Capsule: Principles of environmental Management, current practices in environmental protection and legislation, Policy formulation process in Sri Lanka, Environmental conservation and management policies in Sri Lanka: National Environmental Policy (draft),Provisions in the Penal Code and Code of Criminal Procedure; National Environmental Act, National Environmental Regulations and Orders, Flora and Fauna Protection Ordinance, Coast Conservation Act, System of granting approval for development projects and high polluting industries in Sri Lanka, Environmental Protection licensing (EPL) process, Environmental standards, Environmental management under provincial administration, National & international policies and instruments: National legislation, International conventions: Biodiversity convention: Current practice in conservation, application of biodiversity convention in Sri Lanka.

Course Aim: This course is designed primarily for students who anticipate employment in fields related to environmental policy or management. The aim of this course is to provide relevant theory and background of the environmental management and contemporary research on environmental policy and management. Also student will exposure to actual jurisdictions and policymakers, and opportunities for students to develop and apply appropriate policy development and management skills.

Course ILOs: After completion of this course students will be able to

1. describe and discuss the principles of environmental management and apply the above knowledge to address environmental issues
2. evaluate environmental management policies in Sri Lanka
3. describe the environmental assessment and licensing processes in Sri Lanka
4. explain environmental conventions and protocols that address global environmental issues and discuss their applicability in Sri Lanka
5. applying the provisions in relevant Acts and Ordinances in the management of environment in Sri Lanka.

Resource Requirements: Handouts, Multimedia, computers, White boards, lecture theatres, equipments

Transport Requirements: Two field visits outside the University

Assessment Strategy:

Continuous assessment		-50%
Evaluation of field work	-15%	
Presentations	-10%	
Reports	-25%	
End semester examination		-50 %

References:

8. PW Bernie, AE Boyle and C Redgwell (2009) International Law and the Environment. 3rd ed. Oxford University Press, UK.
9. Global environmental conventions and protocols.
10. Acts and Ordinances relevant to environmental conservation and management in Sri Lanka.
11. CEA (1993) National Environmental Act

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)

Mr. Leel Randeni (email: leelr2001@yahoo.comTel: 0718426244)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: **Wetland Conservation and Management**

Course Code: **BDC 4202** (Theory 24 hrs, Pract. 18 hrs, IL 38 hrs)

Course Capsule: Basic Concepts on Wetland Ecology: Definition and classification of Wetlands, Wetland characteristics: Wetland hydrology, Wetland soils, Wetland vegetation and adaptations; Wetland biogeochemistry with special reference to the importance of inorganic and organic compounds transformations in wetlands, Wetland zonation. Wetland functions and values: Wetland services, wetland values and economic benefits; Major threats to wetlands: Natural and anthropogenic impacts on wetlands, Factors affecting human development in wetlands: Biological diversity of wetlands, Factors affecting animal and plant diversity in wetlands, Monitoring of Wetlands, Managing hydrology; Control of Siltation and Pollution, Restoration of degraded wetlands and wetland creation, along with the construction of wetlands for pollution abatement. Wetland conservation and management, Sustainable use of wetlands

Course Aim: Students will be made familiar with different wetland types and how they are classified, and will develop skills in understanding the interactions between wetland hydrology, hydric soils, hydrophytic vegetation and biological and physico -chemical parameters of wetlands. Students will also gain experience and knowledge on the complex conservation, restoration and management issues associated with wetlands. Field studies on characteristics of selected wetlands and identification of potential threats and impacts. Further laboratory work will cover the latest techniques in environmental analysis needed for contemporary wetland monitoring and experimentation. The course will apprise the

students of the national and global policy environment *vis a vis* wetland management conservation and priorities

Course ILOs: After completion of this course students should be able to

1. recognize the different characters of wetlands
2. explain the values and functions of different types of wetlands
3. discuss the effects of biological and physico-chemical factors on wetland community development and wetland properties,
4. identify potential threats to wetlands and propose appropriate wetland management strategies,
5. discuss the importance of wetland restoration, constructed wetlands, and sustainable utilization of wetlands
6. demonstrate skills in identifying wetlands for conservation, wise use of wetlands and wetland restoration.
7. prepare a management plan for a selected wetland
8. develop a constructed wetland for demonstrate the pollution abatement

Resource Requirements: Handouts, Multimedia, computers, lecture theatres, White board, Field equipment, Laboratory

Transport Requirements: Three field visits outside the University

Assessment Strategy:

Continuous assessment		-25%
Mid- semester	-10%	
Quizzes	-05%	
Group presentations	-10%	
Field component: evaluate field report and wetland		-25%
End semester assessment		-50 %

References:

1. PA Keddy (2010) Wetland Ecology: Principles and Conservation. Cambridge University Press.
2. Selected current review papers published by reputed publishers.
3. Wetland site report series, Central Environmental Authority, Sri Lanka.
4. An integrated Wetland assessment toolkit. IUCN.
5. Ramsar Convention Handbooks
6. Handbooks on Wetland Management by Convention on Biological Diversity.

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: Forest Conservation

Course Code: BDC 4203 [Theory 20 hrs, Practical (Field) 24 hrs, IL 36 hrs]

Course Capsule: Introduction to the Forestry Sector of Sri Lanka and Overview of Natural Forests in Sri Lanka, Multiple-Use Natural Forests: Services and Products, Non-Wood Forest

products, Wood Products and Timber Processing, Assessment of Forest Resources and Inventory Process, Forest Policy, Legislation and Institutions, Conservation of Biodiversity in Forests, Forestry in Soil and Water Conservation, Forest Protection and Forest Influences, Carbon Trading and Sequestration, REDD and REDD+ programmes, Agroforestry and Agroforestry Systems, Social Forestry and Related Systems, Forest Economics and Marketing, Silviculture and Silvicultural Systems, Tree Improvement Methods, Forest Plantations, Homegardens and Non-Forest Tree Resources, Forestry Research, Extension and Future Trends in Forestry.

Course Aim: To review the knowledge on the present status of Sri Lankan forests and forestry sector, forest resources (products and services), conservation issues; to reveal rapid depletion and degradation of our forests, to address remedial measures to mitigate forest declining and to inspire the timely necessity of forest conservation, sustainable management and proper utilization.

Course ILOs: At the end of the course, the students should be able to

1. describe past and present status of the forests, forestry sector and forest conservation issues in Sri Lanka and outline the characteristics of the natural forests in Sri Lanka
2. evaluate the importance of forests, forest resources and multiple-use natural forests, and describe concisely the wood products and timber processing techniques
3. assess forest resources, practice forest mensuration and carryout forest inventory process
4. review forestry policy development, forestry related legal aspects and describe the authorities and institutional framework related to forest conservation in Sri Lanka
5. highlight the importance of forestry in biodiversity, soil and water conservation, and describe the forest influences and forest protection, conservation and management methods in practice
6. describe the Carbon Trading and sequestration and review REDD (Reducing Emissions from Deforestation and Forest Degradation) and REDD+ programmes
7. outline the principles of agroforestry and the basic forest economics and marketing practices in Sri Lanka, and describe the agroforestry systems and involvement of human resources in forestry
8. outline the fundamentals of silviculture, describe silvicultural systems in Sri Lanka, and review the main tree improvement methods
9. describe the role of home gardens, analog forestry and forest Plantations, and verify the significance of them in forest conservation
10. review the forestry research and literature on forestry and postulate the future trends in forestry and forestry sector of Sri Lanka

Resource Requirements:

Lecture: Lecture Theater, Handouts, Multimedia, Computers, White board

Practical: Practical Schedules, Forests and Plantations, Field collecting devices and Bags, Materials needed for Herbarium Techniques, Accommodation and financial support for accommodation and field sessions, Entry Permits for Forests and Plantations.

Transport Requirements: Bus or van for one 2-day field visit and two 1-day field visits

Assessment Strategy:

Continuous Assessment Marks (CAM)	– 50%
Assignments (As)	– 10%
Presentations (Pt)	– 10%
Reports on Field Visits and Field Practicals (Fl)	– 10%
Mid semester exam (Ms)	– 20%
End-semester Theory Marks (ETM)	– 50%

References:

1. T Van Andel (2006) Non-timber forest products - the value of wild plants (Agrodok 39). Agromisa Foundation and CTA, Wageningen. 69 p.
2. M De Zoysa (2001) A Review of Forest Policy Trends in Sri Lanka. Policy Trend Report: 57-68.
3. Forest Products Laboratory. 2010. Wood handbook - Wood as an engineering material. General Technical Report FPL-GTR-190. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 508 p.
4. Forestry Planning Unit [FPU] (1995a). Sri Lanka forestry sectors master plan: National forestry policy and executive summary. Ministry of Agriculture, Lands and Forestry, Sri Lanka.
5. Forestry Planning Unit [FPU] (1995b). An over view of Sri Lanka forestry sector master plan. Ministry of Agriculture, Lands and Forestry, Sri Lanka.
6. Green Economy and Trade - Trends, Challenges and Opportunities – Chapter 4 Forests
7. CVS Gunatilleke and IAUN Gunatilleke (1990) Distribution of Floristic Richness and Its Conservation in Sri Lanka. Conservation Biology, 4 (1): 21-31.
8. N Gunatilleke, R Pethiyagoda and S Gunatilleke (2008) Biodiversity of Sri Lanka. J. Natn. Sci. Foundation, Sri Lanka, 36 (Special Issue): 25-62.
9. VJ Jacob and WS Alles (1987) Kandyan Gardens of Sri Lanka Agroforestry Systems 5: 123-137.
10. F Montagnini and CF Jordan (2005) Tropical Forest Ecology – The Basis for Conservation and Management. Springer. 295 p.
11. PKR Nair (1993) An Introduction to Agroforestry. Kluwer Academic Publishers in Cooperation with International Centre for Research in Agroforestry. 499 p.
12. AC Newton (2007) Forest Ecology and Conservation - A Handbook of Techniques. Oxford University Press. 454 p.
13. A Pemadasa (1996). *The Green Mantle of Sri Lanka*. An Author Publication. Pp 242.
14. KR Shepherd (1986). Plantation silviculture. Martinus Nijhoff Publishers, Dordrecht, The Netherlands. 322 p.
15. E Verheij (2003) Agroforestry (Agrodok 16). Agromisa Foundation, Wageningen. 85 p.

Teaching Panel: Dr W.M.G. Asanga S.T.B. Wijetunga (e-mail: astbw@yahoo.comTel: 0777610876)

Dr. Sampath Wahala

Course Coordinator: Dr W.M.G. Asanga S.T.B. Wijetunga

Course Name: Advanced Geographic Information System

Course Code: BDC 4204 (Theory 25 hrs, Pract. 15 hrs, IL 40 hrs)

Course Capsule: Introduction to Advances in GIS Technology: State of the Art of GIS technologies, Main topics of application; Accuracy of Geo-spatial Databases: Uncertainty of Geo-spatial data, locational Uncertainty Processing, attribute uncertainty processing, S-Buffer Model; Digital Elevation Models. The Analysis of Discrete Entities in Space: Operations on attributes of Geographic Objects, Attribute descriptors; Point descriptors: Central tendency, Dispersion and Distribution, Operations on attributes of Multiple Overlapping entities in space, Cartographic operations; Pattern Detectors: Nearest neighbor analysis, Application; Characteristics of Linear Features: Network analysis, Directional statistics; The spatial pattern descriptors: Spatial relationship, Spatial autocorrelation, Scatter Plots – Moran, Spatial indices; Customization and Automation in GIS: Customization to end user needs, Introduction to programming in GIS, Automation in GIS functionality; GIS on Internet: Scope and concept of Open GIS, Developing an internet GIS.

Course Aims: This module aims to develop the advanced practical and conceptual skills necessary to conduct advanced GIS analysis, modeling, and the theoretical and practical competency necessary to study GIS at a higher level. It aims to introduce the student to commercially available software, instruct students in the use of this software in applied GIS analysis scenarios and ensures a solid theoretical and conceptual foundation in advanced GIS fundamental methods and analyses. This course introduces applications of Geographic Information Systems (GIS): a decision support tool for planners and managers of spatial information. Database development, manipulation and spatial analysis techniques for information generation will be taught. Students will have the scope of using GIS for applications in their related fields such as natural resource management; environment, agriculture, information system, etc. which will be discussed through mini project and laboratory exercises.

Course ILOs: At the end of the course, the students should be able to:

1. apply GIS to real-world problems
2. utilize GIS as a tool in other disciplines
3. distinguish accuracy and precision of geospatial database
4. determine the estimation evaluation and be familiar with evaluation model
5. recognize the Point Interpolations and its concepts on GIS data structures
6. understand the concept of remote sensing principles on data interpretation
7. apply Geographic Information Systems for spatial analyses
8. design and develop a GIS project that relates to the student's academic specialty or area of interest
9. develop practical software skills
10. present a GIS project outside of the GIS environment

Resource Requirements: Handouts, Multimedia, computers, lecture theatres, Arc GIS software, Topography sheets

Transport Requirements: Practicals outside the University

Assessment Strategy:

Continuous assessment		-40%
Quiz	-10%	
Practicals	-10%	

Mini project -20%

End semester assessment -60 %

References:

1. PA Burrough and RA McDonnell (1998) Principles of Geographical Information Systems, Oxford University Press.
2. J Star and J Estes (1990) Geographic Information Systems: An Introduction: Prentice Hall, Englewood
3. NJJ Cliffs DWS Lee and Wong (2002) Statistical Analysis with Arc View GIS: John Wiley and Sons, Inc., New York.

International Journal of GIS
Asian Journal of Geoinformatics

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: **Economics of Biodiversity**

Course Code: **BDC 4205**(Theory 28 hrs, Pract. 15 hrs, IL 37 hrs)

Course Capsule: Definitions for Economics, utility, goods, services, demand, supply, consumer, producer, factors of production. Economics as a social science, rationality, Economic Behaviour in developing countries and in developed countries, culture, institutions and mentalities. Evolution of the discipline Economics (brief), Market equilibrium, producer surplus, consumer surplus, price mechanism, central planned economies and mixed economies. Income, consumption, savings and investments, MPC, MPS, APC and APS, theories of consumption in general and with reference to Biodiversity. Main economic schools of thought: classical, neo-classical, Keynesian, New Classical and New Keynesian.

Course Aim: The aim of this course is to provide the students with the understanding of the basic economic concepts and relationship between economic development and biodiversity. Also explain the different methods of valuation of natural resources. Provide in addition, the legislative framework and institutional involvement of biodiversity conservation. Finally students will be equipped with the knowledge to develop a management plan for the decision making level.

Course ILOs: At the end of the course, the students should be able to:

1. recognize the link between environment, biodiversity, natural resources and economy
2. identify the challenges of balancing biodiversity management and economic development
3. distinguish biodiversity management and conservation
4. develop skills to write, implement and evaluate biodiversity management plans
5. identify the role of institutions and policies in managing biodiversity
6. define, describe and distinguish biological goods and services and industrial goods and services
7. implement appropriate tools to value biodiversity
8. analyze the failures of efficient management of diversity in the general market

9. apply market principles in decision making with regard to natural resources in general

Resource Requirements: Handouts, Multimedia, computers, lecture theatres

Assessment Strategy:

` Continuous assessment - 40%

Mid- semester	- 10%
Reviewing reports	- 10%
practical assignments	- 10%
quizzes	- 10%

End semester assessment - 60 %

References:

1. PALD Nunes, P Kumar, T Dedeurwaerdere (2014) Handbook on the Economics of Ecosystem Services and Biodiversity. Edward Elger Publishing. ISBN: 9781781951507
2. E Nelson (2012) The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations. *In:* J Nat. Res. Policy Res. (ed P Kumar). Routledge. ISBN: 9781849712125
3. A Kontoleon, U Pascual and T Swanson (2007) Biodiversity Economics Principles, Methods and Applications. Cambridge University Press. ISBN:9780521866835

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)

Mr. Sanjaya Fernando (email: sanjaya1f@hotmail.com, Tel: 0779643667)

Course Coordinator: Dr. Sriyani Wickramasinghe

Course Name: **Limnology and Conservation of Aquatic Resources**

Course Code: **BDC 4206** (Theory 28 hrs, Practical 12hrs (Lab 6 hrs, field 6hrs), IL 40 hrs)

Course Capsule: Ecological concepts and function of various aquatic systems (inland and marine), Light energy, thermal regime, water movement and mixing process, nutrient cycle and budget, trophic dynamics and biological productivity in aquatic systems, Pollution of aquatic system: water quality, degradation, indicators of water pollution, pollution mitigating measures. **Conservation:** conservation of aquatic resources and biodiversity

Course Aim: To teach ecological concepts and function of various aquatic systems, pollution of aquatic system, conservation of aquatic resources and biodiversity.

Course ILOs: At the end of the course the student should be able to

1. describe the ecological concepts and function of various aquatic systems (inland, Brackish water and marine)
2. explain the different types of aquatic systems
3. describe the light, energy, water movement, mixing process & nutrient cycle
4. explain the trophic dynamics and biological productivity
5. critically analyze the aquatic pollution
6. explain how to conserve of aquatic resources with special reference to mangroves and wetlands

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Not required

Assessment Strategy:

Continues assessment		-40%
Quizzes/report)	-10%	
Mid semester	-20%	
Presentations	-10%	
End semester (Theory)		-60%

References:

1. CM Lalli and TR Parsons (1997) Biological oceanography an introduction. Butterworth – Heineman publ.
2. KH Mann and JR Lazier (2003) Dynamics of marine ecosystem. 2nded. Blackwell Science
3. HV Thurman and E Charles (1975) Introductory oceanography, Merril pub.
4. RV Tait (1972) Elements of marine ecology, Butterworths
5. HW Harvey (1956) The chemistry and fertility of sea water. Cambridge university press

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email: tvbarathy@yahoo.com, Tel:0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: **Coastal and Marine Biodiversity Conservation**

Course Code: **BDC 4207** (Theory 22 hrs, Pract. 24 hrs, IL 34 hrs)

Course Capsule: Introduction to coastal and marine ecosystems and organisms of Sri Lanka. Coastal communities: Evaluate the marine and coastal production systems including Open sea, Coral reefs, Mangroves, Sea grass beds, Estuaries and lagoons, Marshes, Sand dunes and, Associated terrestrial forests and their ecological and economic importance. Problems and threats associated with coastal and marine ecosystem: Impacts of anthropogenic activities including Coastal tourism, Sewage outfalls, Oil spills, Aquaculture, Global warming, Maritime transport and ballast water disposal, Coral mining and over-fishing on coastal production systems. Natural events including, Tsunamis and tidal waves on coastal production systems, Protected marine organisms of the Sri Lankan Sea: corals, sea grass beds, turtles, dolphins, whales and dugongs. Integrated approaches on marine and coastal management: Use of GIS and remote sensing and mapping on the evaluation and assessment of coastal resources, Participation and role of the government, NGOs and the coastal communities in the sustainable utilization, management and governance of coastal resources. An overview of laws relevant to biodiversity and environmental protection of coastal ecosystems – Marine parks, sanctuaries and reserves of Sri Lanka

Course Aim: The aim of this course is to provide knowledge on concepts to a variety of marine systems and its biodiversity, Effectively communicate the value and importance of different ecosystems including their ecosystem services, the threats to their sustainability, and the actions needed to protect them, give knowledge and skills on integrated coastal and marine resources management to address the management issues in the coastal zone for sustainable development.

Course ILOs: After completion of this course students should be able to

1. identify the different types of coastal and marine ecosystems and its biodiversity

2. evaluate the ecological and economic importance of marine and coastal production systems and identify the importance of establishing marine protected areas
3. describe the major threats to marine and coastal production systems and the methods used to manage the threats
4. explain the role of local and international agreements, NGOs and local coastal communities on the management and sustainable utilization of marine and coastal resources
5. examine the integrated coastal zone management practices in selected coastal regions through field surveys

Resource Requirements: Handouts, Multimedia, computers, lecture theatres, White board, Field equipment, Laboratory

Transport Requirements: Three field visits outside the University

Assessment Strategy:

Continuous assessment		-45%
mid- semester	-15%	
group presentations	-10%	
Field reports	-20%	
End semester assessment		-55 %

References:

1. JR Clark (1995) Coastal Zone Management Handbook. 1st ed. CRC press, 720 pages
2. Conservation management plan, Muthurajawela marsh and Negombo Lagoon (1994). Wetlands conservation project, Central environmental Authority, Sri Lanka.
3. Conservation management plan, Mundellake and Puttalam corridor channel (1994). Wetlands conservation project, Central environmental Authority, Sri Lanka
4. S Kidd, A. Plater and C. Frid (2011) The Ecosystem Approach to Marine Planning and Management.. 1st ed. Routledge 230 pages.
5. M Solan, RJ Aspden and DM. Paterson (2012) Marine Biodiversity and Ecosystem Functioning. *Frameworks, methodologies, and integration*. Published by Oxford University Press, ISBN-13: 9780199642250

Teaching Panel: Dr. Sriyani Wickramasinghe (email: sriwick@gmail.com, Tel: 0718508500)

Course Coordinator: Dr. Sriyani Wickramasinghe

B.Sc. in Applied Biology (Fisheries and Aquaculture Management) Honours Degree Programme

Third Year

BOT 3201 Plant Tissue Culture, ZOO 3202 Applied Parasitology, ZOO 3204 Embryology and Developmental Biology, BIO 3201 Molecular Biology, BIO 3203 Environmental Pollution, BIO 3205 Ecotoxicology, BIO 3206 Experimental Design and Nonparametric Methods in Statistics, BDC 3203 Introduction to GIS, FAM 3201 Fisheries and Aquaculture, FAM 3302 Breeding Techniques in Aquaculture, FAM 3303 Ornamental Fishery, MIB 3204 Food Microbiology(26 Credits) which are available as optional courses for B.Sc. in Applied Sciences are made compulsory for this study programme.

In addition, BOT 3202 Principles and Practice of Horticulture and Landscaping, BIO 3102 Ecotourism, BIO 3204 Bioinformatics, BDC 3202 Environmental Impact and Risk Assessment, BDC 3203 Introduction to GIS, BDC 3204 Wildlife Management and Conservation (11 Credits)

are also available as optional courses for the students following this Honours Degree Programme.

Fourth Year

Course Name: **Fishery Resources Management**

Course Code: **FAM 4201** (Theory 30 hrs, Field visit 06 hrs, IL 44 hrs)

Course Capsule: Marine fishery resources – Deep sea, offshore and coastal Resources; Brackish water fishery resources – Lagoons and estuaries; Inland fishery resources – Streams, rivers, reservoirs, perennial and seasonal tanks; Importance and constraints in fish stock assessments; Development of empirical models for fish yield predictions; Population dynamics; Overfishing; Community based fisheries management; Co-management of fishery resources; Role of legislature in fisheries management, use of GIS in Fisheries; Pollution and its effects on fisheries and aquaculture.

Course Aim: To teach fishery resource management focusing on management tools, stock assessment and use of GIS in fisheries

Course ILOs: At the end of the course the student should be able to

1. describe the fishery resources of Sri Lanka
2. discuss the fisheries management approaches
3. describe the importance and constraints in fish stock assessments and population dynamics
4. identify the major issues constraining the development of fisheries sector
5. identify the institutions and legislation relevant to aquatic environment, living resources and habitats in Sri Lanka
6. develop empirical models for fish yield predictions and use software to obtain fisheries statistics
7. estimate Maximum Sustainable Yield and describe biological overfishing of tropical stocks
8. use GIS in fisheries
9. discuss the pollution and its effects on fisheries and aquaculture
10. identify constraints and propose the future prospects of fisheries management

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Required for field visit

Assessment Strategy:

Continues assessment		-50%
Quizzes/report)	-10%	
Mid semester	-20%	
Presentations	-10%	
End semester (Theory)		-50%

References:

1. JE Thorpe, GA Gall, JE Lannan, and CE Nash (1995) Conservation of fish and shellfish resources: Managing diversity. Elsevier.

2. F Berkes (2001) Managing small-scale fisheries: alternative directions and methods. IDRC.
3. RS Pomeroy and R Rivera-Guieb (2005) Fishery co-management: a practical handbook. CABI
4. I Wellby, A Girdler, R Welcomme (2010) Fisheries Management: A manuals for still-water coarse fisheries. Wiley- Blackwell.
5. J Urquhart, TG Acott, D Symes, M Zhao (2014) Social Issues in Sustainable Fisheries Management. Springer.
6. SL Jason (2010) Ecosystem-Based Fisheries Management. Cambridge University Press
7. R Hans-Joachim (2012) The obligation of sustainable fisheries management: Review of endured failures and challenges in exploitation of the living sea. Intec.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email: tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: Aquaculture Engineering

Course Code: FAM 4202 (Theory 30hrs, Field visit 08hrs, IL 42hrs)

Course Capsule: Hydrological information for design and operation of aquaculture systems, Soil engineering for design of ponds, canals and dams, Design and construction of fish farms, ornamental aquatic plant production centers and maintenance of aquafarms, Pond construction engineering, design and construction of fish cages, tanks, and other impounding structures, hatchery units, classification and design of different types of water pumps, types of aeration and filtration devices used in ponds, their design and construction. Waste management techniques in aquaculture production, biofiltration system used in ponds, type of aerators, degassing etc. Water recirculation systems

Course Aim: To teach the designing, construction of farms, ponds, hatcheries and related devices and systems in aquaculture.

Course ILOs: At the end of the course the student should be able to

1. discuss the role of aquaculture engineering in aquaculture production
2. explain the hydrological information for design and operation of aquaculture systems
3. select the sites and evaluate the quality of soil for designing of ponds, canals and dams
4. design fish farms and instruct the farmers to construct aquaculture farms
5. design shrimp hatcheries
6. design and construct ponds
7. design fish cages, tanks, and other impounding structures
8. classify and design different types of water pumps
9. design aerators and filtration devices
10. discuss the waste management techniques in aquaculture production
11. design water recirculation systems

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Required for field visit

Assessment Strategy:

Continues assessment		-50%
Quizzes/report)	-10%	
Mid semester	-20%	
Presentations	-10%	
End semester (Theory)		-50%

References:

1. MCM Beveridge (1987) Cage Aquaculture, Blackwell Science, Oxford
2. TVR Pillay, (1990) Aquaculture; Principles and Practice. Fishing News Books, Oxford.
3. SN Ghosh and AN Bose (1991) Coastal aquaculture engineering.CUP Archive
4. CJ Shepherd and NR Bromage (1992) Intensive Fish Farming. Blackwell Science, Oxford.

5. NR Bromage and RJ Roberts (1995) Brood Stock Management and Egg and larval Quality. Blackwell Science, Oxford.
6. MP Masser, J Rakocy and TM Losordo (1999).Recirculating aquaculture tank production systems. Management of recirculating systems. SRAC Publication, 452.
7. J Tidwell (2012) Aquaculture production systems.John Wiley & Sons.
8. O-I Lekang (2013) Aquaculture Engineering. Wiley-Blackwell.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email: tvbarathy@yahoo.com,Tel:0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: Aquafarming of Macrophytes

Course Code: **FAM 4203** (Theory 26 hrs, Pract. 12 hrs, IL 42 hrs)

Course Capsule: Introduction to aquatic and amphibious plants and ornamental aquatic plants, Ornamental properties and adaptations of aquatic and amphibious plants, Water bodies of Sri Lanka, Zonation of Lentic water bodies and their plant diversity, Native and introduced aquatic plants of Sri Lanka, Marine angiosperm and other angiosperms in saline and brackish waters, Aquatic weeds and Invasive Alien Species (IAS): their natural balance and governing factors in natural habitat; Menace of aquatic weeds, Major aspects in the management of aquatic weeds, Flowering and foliage ornamental aquatic plants and their important economic and ecological aspects, Methods of propagating aquatic plants, Designing aquaria, ponds, water gardens and terrariums, Legislation, Quarantine, feasibility and future prospects of ornamental aquatic plant industry in Sri Lanka. Seaweeds: their biology, introduction including history, methods of seaweed farming and harvesting, nutritional value, medicinal importance and industrial uses, Necessity, feasibility and future prospects of seaweed farming in Sri Lanka.

Course Aim: To teach the diversity of local aquatic plants available so that the students would appreciate their uses in diverse income generating avenues, train to detect and manage menace of aquatic weeds in natural water bodies, master the techniques in making terrariums, learn legislation regarding ornamental aquatic plant industry in Sri Lanka, critically evaluate the necessity and feasibility of ornamental aquatic plant industry and seaweed farming in Sri Lanka.

Course ILOs: At the end of the course, the students should be able to

1. identify and describe ornamental properties and adaptations of aquatic and amphibious plants and emphasize their ecological significance
2. identify and classify the local water bodies and illustrate the zonal variations of lentic waters
3. describe the different types of native and introduced aquatic plants emphasizing the available potential ornamental aquatic plants
4. identify native and exotic aquatic fresh water plants and angiosperms in saline and brackish waters in Sri Lanka up to their species level and to evaluate their economic and ecological importance
5. explain the threats of invasive alien species (IAS) of aquatic plants to native aquatic flora and to identify IAS precisely

6. explain the factors influencing the conversion of aquatic plants to aquatic weeds and their spread, identify the menace and recommend the methods of control and management of aquatic weeds
7. describe the basic requirements to grow aquarium plants and methods suitable to propagate aquatic plants
8. design terrariums, aquaria, ponds and water gardens
9. describe the important facts regarding legislation, quarantine and current status of Ornamental Aquatic Plant Industry in Sri Lanka
10. discuss the importance of seaweed farming and its feasibility in Sri Lanka

Resource Requirements:

Lecture: Lecture Theater, Handouts, Multimedia, Computers, White board and Markers

Practical: Practical Schedules, Live specimens, Plant Products, Laboratories, Laboratory equipment like oven, autoclave, laminar floor, Light Microscope, Dissecting/Stereoscopic Microscope, Glassware, Trays, Slides & Cover-slips, chemicals for media preparation

Transport Requirements: Van for field visits

Assessment Strategy:

Continuous assessments		-50%
Practicals	-20%	
Quizzes	-10%	
Assignments	-10%	
Mini project	-10%	
End semester theory		-50%

References:

1. S Borman, R Korth and J Temte (2001) Looking through the glass - A field guide to aquatic plants.
2. S Buczacki(1995) Best water plants. Hamlyn-Reed Books Ltd, London.
3. CDK Cook, (1990) Aquatic Plant Book. SPB Academic Publishing, The Hague, The Netherlands.
4. L Gunasekera (2009) Invasive Plants: A guide to the identification of the most invasive plants of Sri Lanka, Colombo, Sri Lanka.
5. B Marambe, P Silva, S Wijesundara and N Atapattu (2010) Invasive Alien Species - Strengthening Capacity to Control Introduction and Spread in Sri Lanka. Biodiversity Secretariat of the Ministry of Environment, Sri Lanka.
6. OG Mouritisen (2013) Seaweeds. Univ. of Chicago Press, Chicago.
7. P Rhatigan (2009) Irish Seaweed Kitchen. The comprehensive guide to healthy everyday cooking with seaweeds. Booklink, Holywood
8. Videos - Seaweed farminghttps://www.youtube.com/watch?v=jcY2VyAUXwI
9. The Nutritional Benefits of Seaweedshttps://www.youtube.com/watch?v=cw728MiOKg8

Teaching Panel: Dr. (Mrs.) Priyani L. Hettiarachchi (email: phlakshmi@yahoo.com, Tel: 0771238980)
Dr. W.M.G. Asanga S.T.B. Wijetunga (e-mail: astbw@yahoo.com,Tel: 0777610876)

Course Coordinator: Dr. W.M.G. A.S.T.B. Wijetunga

Course Name: **Fish Nutrition and Growth**

Course Code: **FAM 4204** (Theory 27 hrs, Practical 09 hrs, IL 44 hrs)

Course Capsule: Principles of nutrition, nutrient requirements of different fish species, essential nutrients and their functions, artificial and natural feed types, deficiency symptoms, nutritional bioenergetics, vitamins and mineral mixtures, nutrient sources, evaluation of ingredients, toxins in ingredients, larval feeds, grow out feeds, supplemental feeds, complete feeds, brood stock feeds, culture of different live feed types – *Artemia, Daphnia,* rotifers etc., feed formulation, feeding regimes and feed manufacture, problems in storage and preventive measures, diet analysis and nutritional evaluation, feed management, feeding methods, feeding rates and supplemental feeding

Course Aim: To teach the principles of nutrition, nutrition requirement of fish species, different types of feeds, formulation of fish feed and storage.

Course ILOs: At the end of the course the student should be able to

1. explain the nutritional energetics and factors affecting the energy partitioning
2. discuss the nutrition, metabolism and deficiency syndromes of fish
3. discuss different types of fish feeds
4. describe the different types of artificial feeds
5. discuss the different feed resources/ ingredients used in fish feeds
6. discuss the different feed additives
7. explain how to select the feed ingredients for feed formulation
8. formulate the feed manually and using software
9. prepare different artificial fish feeds and analyse the nutrient content of the feed
10. describe the storage of artificial fish feed
11. describe the contaminants of artificial fish feeds
12. discuss the feeding of fish feed
13. discuss the quality control of fish feed manufacturing
14. produce live feeds for fish

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres
Transport Requirements: Not required

Assessment Strategy:

Continues assessment		-50%
Quizzes/report)	-10%	
Mid semester	-20%	
Presentations	-10%	
End semester (Theory)		-50%

References:

1. T Lovell (2002) Nutrition and Feeding of fish. ebook
2. C Lim (2001) Nutrition and fish health. Food product Press, New York
3. EH John and WH Ronald (2002).Fish Nutrition. Academic Press
4. S De Silva, S Anderson, A Trevor (2009) Fish Nutrition in Aquaculture. Chapman and Hall

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email:tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: **Fish Health Management**

Course Code: **FAM 4305** (Theory 30hrs, Pract. (Field15hrs, Training 30hrs) IL 45 hrs)

Course Capsule: Principles of fish health management; Economic importance of health management; Predisposing factors; Environmental stress; Introduction to infectious and non-infectious disease agents and processes in cultured organisms; Infectious diseases: bacteria, fungi, viruses, parasites, host pathogen and environmental relationship; Clinical signs, behavioral changes and pathology; Disease diagnosis, microbiological and other techniques involved in diagnosis; Prevention of diseases – tracing and eliminating sources of infection, disinfection; Control-isolation, quarantine; Non-infectious diseases - dietary deficiencies, genetic abnormalities, neoplasms; Treatment methods, disease management.

Course Aim: To teach fish diseases, pathogens, symptoms, treatments and health management of cultured fin fish and shell fish

Course ILOs: At the end of the course the student should be able to

1. Explain the principles and economic importance of fish health management
2. discuss the bio-security in aquaculture & Best Management Practices (BMP's)
3. explain how to quarantine to prevent pathogen entry into fish culture facilities
4. discuss the stress in fish & pre-disposable factors
5. identify the infectious diseases and parasitic diseases of fish & shell fish and control measures
6. describe fish-borne Zoonoses
7. identify non-infectious diseases and/or ill-health conditions occurring in fishes & shell fish
8. describe the environmentally induced diseases and their control measures
9. identify the nutritional deficiency diseases in fish & shell fish
10. safety of aquaculture products for consumption

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Required for field visit

Assessment Strategy:

Continues assessment		-50%
Quizzes/report)	-10%	
Mid semester	-20%	
Presentations	-10%	
End semester (Theory)		-50%

References:

1. DV Lightner (1996) A Handbook of Pathology and Diagnostic Procedure for diseases of Penaeid Shrimp. The world Aquaculture Society, Louisiana,
2. M Hettiarachchi and DC Hettiarachchi (2005) Diseases ofOrnamental Fish of Sri Lanka (in Sinhala) Microetec Laboratories Pvt Ltd., 247/D, Christian Perera Place, Dalugama Kelaniya.
3. AD Scarfe, CS Lee and PJ O'Bryen (2008) Aquaculture biosecurity: prevention, control, and eradication of aquatic animal disease. John Wiley & Sons.

4. CS Tucker and JA Hargreaves (2009) Environmental best management practices for aquaculture. John Wiley & Sons.
5. JN Edward (2010) Fish Disease: Diagnosis and Treatment. Wiley-Blackwell
6. JA Plumb and LAQ Hanson (2011) Health maintenance and principal microbial diseases of cultured fishes. John Wiley & Sons.
7. B Austin (2012) Infectious Disease in Aquaculture -Prevention and control. Woodhead Publishing Limited.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email:tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr.(Mrs.) T.V. Sundarabarathy

Course Name: **Postharvest Techniques in Fisheries**

Course Code: **FAM 4306** (Theory 30hrs, Practicals (Field 20 hrs, Training 30 hrs) IL 40 hrs)

Course Capsule: Principles of fish health management; Economic importance of health management; Predisposing factors; Environmental stress; Introduction to infectious and non-infectious disease agents and processes in cultured organisms; Infectious diseases: bacteria, fungi, viruses, parasites, host pathogen and environmental relationship; Clinical signs, behavioral changes and pathology; Disease diagnosis, microbiological and other techniques involved in diagnosis; Prevention of diseases – tracing and eliminating sources of infection, disinfection; Control-isolation, quarantine; Non-infectious diseases - dietary deficiencies, genetic abnormalities, neoplasms; Treatment methods, disease management

Course Aim: To teach nutritive value, quality and postmortem changes in fish, factors affecting the quality and quality control of fish and fishery products, traditional and modern techniques of fish processing and develop HACCP systems for industrialists.

Course ILOs: At the end of the course the student should be able to

1. describe the nutritive value, quality and postmortem changes in fish
2. discuss the effects of maturation and spawning on fish quality
3. discuss the hygiene and sanitation
4. determine quality of fish
5. adopt HACCP concept and food safety
6. process fish using different methods

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Required for field visit

Assessment Strategy

Continues assessment	-50%
Quizzes/report)	-10%
Mid semester	-20%
Presentations	-10%

End semester (Theory) -50%

References:

1. KK Balachandran (2001) Postharvest Technology of Fish and Fish Products. Daya Publishing House.
2. SL John, CS Paul and B Allan B (2013) Postharvest Technology and Processing. Blackwell Publishing.
3. HH Huss, (1995) Quality and Quality Changes in fresh fish, FAO Fisheries Technical Paper No. 348, FAO, Rome.
4. HH Huss (1994) Assurance of Seafood Quality.FAO Fisheries Technical Paper No. 334. FAO, Rome.
5. TJ Connel (1980) Advances in Fishery Science and Technology, Fisting News (Books) Ltd, Farnham, Surrey.
6. A Reilly (1985) Spoilage of Fish and Product Development, FAO Fisheries Technical Paper No. 317
7. RM Love (1970) The Chemical Biology of Fishes. Academic Press, London.
8. MG Meilgaard, V Civille, and BT Carr 1991. Sensory Evaluation Techniques.CRC Press, Bocan Raton, FA, USA.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email:tvbarathy@yahoo.com, Tel: 0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

Course Name: **Fisheries Socioeconomics**

Course Code: **FAM 4207** (Theory 30 hrs, IL 50 hrs)

Course Capsule: Introduction to economics; factors affecting the economics of aquaculture and fisheries in micro and macro scales; production economics and marketing socioeconomics; investment planning and economic feasibility analysis; farm income concept and productivity valuation; farm budgeting and cash flows; record keeping and accounting; profit maximization, laws, regulations and constrains; bioeconomic analytical models; current and potential markets, evaluation of the market potential, market development and entry. Sociological factors in the fisheries sector development.

Course Aim: To teach laws and regulations associated with economics, skills in investment planning, economic feasibility analyses, farm budgeting, record keeping, maintaining cash flows, accounting and sociological factors in the fisheries sector development.

Course ILOs: At the end of the course the student should be able to

1. discuss the factors affecting the economics of fisheries and aquaculture
2. describe the production economics, marketing and socioeconomics
3. explain the investment planning and economic feasibility analysis
4. explain how to do the farm income concept and productivity valuation
5. explain how to keep the records and accounts; maximize profit, laws, regulations and constrains
6. explain how to produce the bioeconomic analytical models
7. discuss the current and potential markets
8. evaluate the market potential

9. discuss the sociological factors in the fisheries sector development

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: Not required

Assessment Strategy:

Continues assessment		-40%
Mid semester	-20%	
Presentations	-10%	
End semester (Theory)		-60%

References:

1. MJA Butler,M.J.A. *et al.* (1986) Marine Resources Mapping: An Introductory Manual. FAO Fisheries Technical paper. No 274. FAO, Rome
2. P Sparre and SC Venema (1992) Introduction to Tropical Fish Stock Assessment. FAO Fisheries Technical Paper No. 335. FAO, Rome
3. FAO (1994, Review of the State of World Marine Fishery Resources, FAO Fisheries Technical Paper No. 335. FAO Rome.

Teaching Panel: Dr. (Mrs.) T.V. Sundarabarathy (email: tvbarathy@yahoo.com, Tel:0776912401)

Course Coordinator: Dr. (Mrs.) T.V. Sundarabarathy

B.Sc. in Applied Biology (Microbiology) Honours Degree Programme

Third Year

BOT 3203 Postharvest Technology of Plant Products, BIO 3201 Molecular Biology, BIO 3203 Environmental Pollution, BIO 3204 Bioinformatics, BIO 3205 Ecotoxicology,BIO 3206 Experimental Design and Nonparametric Methods in Statistics, MIB 3201 Industrial Microbiology, MIB 3202 Soil Microbiology, MIB 3203 Virology, MIB 3204 Food Microbiology, MIB 3205 Plant-Microbe Interactions (22 Credits) which are available as optional courses for B.Sc. in Applied Sciences are made compulsory for this study programme.

In addition, BOT 3201 Plant Tissue Culture, ZOO 3202 Applied Parasitology, BDC 3203 Introduction to GIS (06 Credits) are also available as optional courses for the students following this Honours Degree Programme.

Furthermore, there are 6 more credits available in the Third Year in the specialization area of Microbiology viz. MIB 3206 Analytical Techniques in Biology, MIB 3207 Immunology and MIB 3208 Environmental Microbiology. These are compulsory courses for these students.

Course Name: **Analytical Techniques in Biology**

Course Code: **MIB 3206**(Theory 23 hrs, Pract. (including lab visit) 20 hrs, IL 37 hrs)

Course Capsule: Extraction, fractionation, purification and characterization of organelles and biomolecules: Extraction techniques, Centrifugation (analytical and preparative), fractional precipitation using salt and organic solvents, dialysis, column chromatography (size exclusion, ion exchange and affinity)and Electrophoresis (PAGE, SDS- PAGE, Isoelectric focusing and two dimensional gel electrophoresis), spectroscopy: Absorbance, transmission, fluorimetry; Chromatography in analysis and preparation of micromolecules;

Thin Layer and Paper chromatography, High Performance Liquid Chromatography (HPLC), Medium Pressure Liquid Chromatography (MPLC),Gas Chromatography with Mass Spectroscopy (GCMS),Qualitative and quantitative methods of analyzing separated compounds; ELISA:

Course Aim: To teach the principles, procedures and applications of techniques used in biology to enable the student to make an educated judgment on selection of techniques or combination of techniques for a given problem/ situation in biology

Course ILOs: At the end of the course the student should be able to

1. explain the fundamentals and applications of techniques used in extraction, fractionation, separation/ purification and characterization of organelles and biomolecules
2. describe the principles and applications of spectroscopy, centrifugation, gel electrophoresis, chromatography and ELISA
3. discuss the innovative features of basic techniques for adopting those for both preparative and analytical purposes
4. contemplate on the level of precision and realism
5. decide on the choice of suitable analytical technique(s) for a given purpose
6. perform analysis with lab equipment

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: Van to visitan analytical laboratory

Assessment Strategy:

Continuous assessment		- 50%
Essays/ Reports	- 10%,	
Class test	- 10%	
Presentations	- 10%	
Practicals	-20%	
End semester assessment		- 50 %

References:

1. A Satinder (2003) Chromatography and Separation Science, Academic Press
2. J Graham (2001) Biological Centrifugation (The Basics), Garland Science
3. J Adds andELarkcom(1999) Tools, Techniques & Assessment in Biology: Nelson Advanced Science (Nelson Advanced Science: Biology S.), Nelson Thornes.
4. B Narayan (1998) Fundamentals of spectroscopy. Allied Publishers Private Ltd., New Delhi

Teaching Panel: Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 0771101501)
Dr. (Mrs.) Priyani L. Hettiarachchci (email: phlakshmi@yahoo.com, Tel: 0771238980)

Course Coordinator: Prof. Sanath Hettiarachi

Course Name: Immunology

Course Code: MIB 3207 (Theory 26 hrs, Pract. 12 hrs and IL 32 hrs)

Course Capsule: Introduction to immunology; concepts, terminology and overview, Cells in immunity, Innate and adaptive immunity, Maturation, activation and regulation of lymphocytes Antibodies; types, structure and function, Ig diversity, T cell receptors, Complement system, MHC molecules, Autoimmune diseases, Cytokines and Immune Function, Immunity in defense against transplantation and tumors, Techniques in immunology.

Course Aim: The course aims to elaborate on the structural features of the components of the immune system as well as their functions with primary emphasis on mechanisms involved in immune system development and responsiveness. The major experiments that allowed the elucidation of these mechanistic features will be utilized to help understand how immunologists think and work.

Course ILOs: At the end of this course students should be able to;

1. differentiate types of immunity
2. describe the lineage of cells of immune system and rationalize their importance
3. justify the need for antibodies and their diversity
4. review the consequences of antigen-antibody binding
5. rationalize signaling process in the immune system
6. propose mechanisms and etiology ofauto immune diseases
7. explain the importance of cytokines
8. describe the immune development against cancer and transplantation
9. describe and demonstrate techniques related to immunology
10. review new developments in immunology
11. prepare slides from samples and identify cells in the immune system

Resource Requirements: Handouts, Multimedia, computers, interactive whiteboard, video camera,Specimens and slides, Molecular Biology& Microbiologylaboratories, Interactive lecture theatre and lecture theatres,

Transport Requirements: Vehicle for ten people to visit VRI, Gannoruwa.

Assessment Strategy:

Continuous assessment		- 40%:
Quiz	-10%,	
Student presentation	-20%,	
Viva	-10%	
End semester assessment		-60%
End term paper	-50%	
Practical spot test	-10%	

- Weeks 1-7 will be used to generate the quiz (Midterm).
- Weeks 9-13 will be used to develop viva questions

References:

Books

1. K Abul, AHH Abbas and SP Lichtman (2014) Cellular and Molecular Immunology 8th ed. Y, Saunders, USA

2. H Chapel, M Haeney, S Misbah and N Snowden (2014) Essentials of Clinical Immunology, 6th ed. Wiley-Blackwell, USA
3. J Owen, J Punt and S Stranford (2013) Kuby Immunology, 7th ed. WH Freeman, USA
4. LM Sompayrac (2012) How the Immune System Works, 4th ed. Wiley-Blackwell, USA

Journals

1. BMC Microbiology, Springer, USA
2. Journal of Applied Genetics, Springer, USA

Teaching Panel: Dr T. Chathuranga Bamunuarachchige (heroiraj@gmail.com), Mr Gayan D. Abeysinghe (gayandak1@gmail.com)

Course Coordinator: Dr T. Chathuranga Bamunuarachchige

Course Name: **Environmental Microbiology**

Course Code: **MIB 3208** (Theory 24 hrs, Pract. 16 hrs, IL 40 hrs)

Course Capsule: Bioremediation: substrate, organisms, environment, acclimation, Carbon utilization and technologies available, Microbes in biogeochemical cycling in terrestrial and aquatic environments and the influence on human, Biofilms, Microbial communities in extreme environments, energy from wastes, Solid wastes management in urban communities, Student seminars on current environmental issues, Practical assignments: sampling, isolation strategies

Course Aim: To be able to conceptualize environmental cleanup operation integrating the knowledge on nature of waste material, natural processes of microflora, behavior of microbial communities in extreme environments, principles and practice of bioremediation/ waste management including biodegradation and energy generation in order to contribute to a cleaner world.

Course ILOs: At the end of the course, the student should be able to

1. explain the principles and importance of bioremediation
2. describe the technologies in bioremediation
3. discuss the positive and negative impacts of biogeochemical cycling on humans
4. describe the process of formation of biofilms and their importance
5. appraise the effects of extreme environments on diversity of microorganisms
6. relate biofuel production and waste management
7. propose suitable measures for solid waste management in cities in Sri Lanka
8. discuss emerging microbial issues related to environment
9. design and carry out simple experiments in environmental microbiology

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres, Transport facilities

Transport Requirements: Visit to a municipal solid waste management facility, Visit to a sewage treatment plant

Assessment Strategy:

Continuous assessment		- 40%
Essays	- 15%,	
Practical assignments	- 15%	
Presentations	- 10%	
Proposal development		- 10%
End semester assessment		- 50 %

References:

1. IL Pepper, CP Gerba, TJ Gentry (2015) Environmental microbiology, 3rd ed. Elsevier (579PEP)
2. RM Maier, IL Pepper, CP Gerba (2009) Environmental microbiology, 2nd ed. Elsevier (579MAI)
3. PD Sharma (2005) Environmental microbiology. Narosa Publishing House, New Delhi (579SHA)
4. RE Mckinney (2004) Environmental pollution control microbiology. Marcel Dekker, New York (628.5MCK)

.**Teaching Panel**: Prof. Sanath Hettiarachi (email: sanath.hetti@gmail.com, Tel: 0771101501)
Mrs. P. Neelamani Yapa (email: pnyapa40@yahoo.co.uk)

Course Coordinator: Prof. Sanath Hettiarachi

Fourth Year

Course Name: Applied Mycology

Course Code: MIB 4201 (Theory 23 hrs, Pract. 21hrs, IL 36 hrs)

Course Capsule: Morphological, physiological and biochemical characteristics of yeast and filamentous microscopic fungi important in the food industry , their uses and undesirable effects such as deterioration of food, contamination and mycotoxin formation; fungi as agents of biodeterioration in cultural artifacts, role of fungi in medical biotechnology and biodegradation of organic matter, strategies for development of mycoherbicides, biological control of fungal diseases on crops, Symbiotic associations of fungi, types of mycorrhizae, functions of mycorrhizal fungi in forest and agricultural ecosystem, commercialization of arbuscular mycorrhizal biofertilizers, fungi as plant growth promoters and plant disease suppressors, marine and fresh water fungi and their applications, review of nutritional and medicinal value of fungi, mushroom production technology, biocontrol of mushroom pathogens, introduction to lichens, lichens as bioindicators, medicinal value of lichens and lichenin acids, modern trends in applied mycology.

Course Aim: To provide a wide knowledge regarding applications of mycology in food, medicine and agriculture, to learn technological and biological concepts in mushroom cultivation emphasizing its applicability in Sri Lanka, to teach modern methods of fungal growth control using natural antimicrobial sprays and microorganisms, to evaluate the use of lichens as bioindicators, to provide thorough understanding of the concepts, values and

applications so that students will be encouraged to undertake research related to applied mycology.

Course ILOs: At the end of the course the student should be able to

1. describe morphological, physiological and biochemical characteristics of yeast and filamentous microscopic fungi important in the food industry and biotechnology
2. discuss the importance of fungi in different microbiological and biotechnological processes
3. explain some undesirable effects of fungi : food deterioration, mycotoxin formation, bio-deterioration of cultural artifacts
4. analyze the importance and strategies of fungal growth control with natural and biological methods
5. explain the multiple role of mycorrhizal symbionts and other rhizosphere microorganisms in terrestrial ecosystem.
6. review significant edible and medicinal fungi and distinguish some edible mushrooms from similar looking, non-edible fungal fruiting bodies
7. evaluate the techniques and conditions used in cultivating, growing , harvesting and postharvest treatment of edible mushrooms
8. describe current, important findings in mycorrhizal research and how these are important to understanding ecosystem functions
9. identify some common lichens and their symbiotic partners in different climatic zones of Sri Lanka
10. identify research fields in modern applied mycology

Resource Requirements: Handouts, multimedia, computers, laboratories, lecture theatres

Transport Requirements: A van to go to Udawattakele, Kandy

Assessment Strategy:

Continuous assessment		-50%
Reports	- 05%,	
Presentations	- 10%	
Group discussions	- 05%	
Practical skills evaluation	- 20%	
Field guide	- 10%	
End semester theory examination		- 50 %

Practical skills will be assessed continuously in the class work (no end semester practical exam).

References:

1. SE Smith and DJ Read (1997).Mycorrhizal Symbiosis, 2nd ed. Academic Press,N.Y.
2. JS Tkacz and L Lange (2012). Advances in fungal biotechnology for industry and medicine, Springer science and business media.
3. DL Spahr (2009). Edible and medicinal mushrooms of New England and Eastern Canada, North Atlantic Books

Primary reading materials will consist of current review journal articles.

Teaching Panel: Mrs. P. Neelamani Yapa (pnyapa40@yahoo.co.uk)
Mr. Gayan D. Abeysinghe (email: gayandak1@gmail.com, contact: 0715601760)

Course Coordinator: Mrs. P. Neelamani Yapa

Course Name: Medical Microbiology

Course Code: MIB 4302 (Theory 40 hrs, Pract. 22 hrs and 58 IL hrs)

Course Capsule: Normal microbial flora, introduction to bacterial diseases, Different groups of bacterial pathogens, medically important fungi, specimen collection and processing, isolation and identification of pathogenic bacteria, Antibiotics Susceptibility Testing (ABST), Mode of Action of Antimicrobial Drugs, Disposal of microbiological waste.

Course Aim: To present the student with the basic concepts of medical microbiology, more specifically about the pathogenic microorganisms associated with each organ system.

Course ILOs: At the end of this course, students should be able to

1. describe the importance of normal microbial flora
2. list and explain major microbial diseases affecting different systems of the human body
3. describe and identify different microbial pathogenic groups
4. examine and characterize different microbial pathogens
5. categorize fungal pathogens based on their morphological features
6. propose fungal pathogens and describe their modes of action for given case studies
7. judge the correct processing according to the collected specimen
8. distinguish the difference in antibiotic sensitivity patterns of given microbes
9. review different modes of action of antibiotics
10. propose the disposal methods for given microbiological waste

Resource Requirements: Handouts, Multimedia, computers, interactive whiteboard, video camera, Specimens and slides, Botany, Molecular Biology & Microbiology laboratories, Interactive lecture theatre and lecture theatres,

Transport Requirements: Vehicle for ten people to visit Teaching Hospital, Anuradhapura.

Assessment Strategy:

Continuous Assessment		-30%
Midterm	-20%:	
Lab reports	-10%	
End semester Assessment		-70%
Theory	- 50%	
Practical test	-20%	

References:

Books

1. D Greenwood, R Slack, J Peutherer and M Barer (2012) Medical Microbiology 18th ed. Churchill Livingstone, USA.
2. PR Murray, KS Rosenthal and MA Pfaller (2015)Medical Microbiology, 8th ed. Elsevier, USA.

3. K Ryan, CG Ray, N Ahmad, WL Drew, MLagunoff, and P Pottinger (2015) Sherris Medical Microbiology, 6th ed. McGraw-Hill Education, USA.

Journals

1. PLOS Pathogens, USA.
2. BMC Microbiology, UK
3. International Journal of Medical Microbiology, Germany

Teaching Panel: Dr T. Chathuranga Bamunuarachchige (heroiraj@gmail.com)
Mrs. D.M.J. Dissanayaka

Course Coordinator: Dr T. Chathuranga Bamunuarachchige

Course Name: Molecular Microbiology

Course Code: MIB 4103 (Theory 15 hrs and IL 25 hrs)

Course Capsule: Quorum sensing, Bacterial two component systems, Bacterial secretion, Protein trafficking in eukaryotic microbes, Bacterial chemotaxis, Sporulation as a means of coping with environmental stresses, Bacterial DNA repair systems, Drug resistance mechanisms, Signal transduction cascades in microbes, Avoidance of host defense, New developments in the field of Molecular Microbiology.

Course Aim: To teach Molecular Microbiology which provides an insight into molecular mechanisms of microbial phenomena, leading to better understanding of how microbes respond to signals and changes in the environment including stresses, providing novel tools for applied microbiology.

Course ILOs: At the end of this course students should be able to;

1. describe population based gene expression regulation in bacteria
2. explain signaling processes in bacteria that aid their survival
3. describe the need for different secretion injectors
4. propose strategies to control microbes based on their signaling mechanisms
5. justify the existence of different DNA repair systems in bacteria
6. explain microbial strategies to overcome adverse conditions
7. suggest strategies to control antibiotic resistance
8. design customized product secretion to improve yield
9. review new phenomena related to molecular microbiology
10. critically analyze the success of microbes in overcoming adverse conditions

Resource Requirements: Handouts, Multimedia, computers, interactive whiteboard, video camera, Interactive lecture theatre.

Transport Requirements: Not required

Assessment Strategy:

Continuous assessment -40%:

Quiz	-10%
Individual Poster	- 20%
Viva	- 10%

End semester assessment -60%

References:

Books

1. HD Persing , FC Tenover, RT Hayden, A Van Belkum (2015)Molecular microbiology: Diagnostic principles and practice 3rd ed. ASM Press, USA.

Journals

1. Microbiology and Molecular Microbiology Reviews, USA
2. Applied and Environmental Microbiology, ASM, USA

Teaching Panel: Dr. T. Chathuranga Bamunuarachchige (heroiraj@gmail.com,Tel:0718096400), Mr. Gayan Abeyasinghe (gayandak1@gmail.com)

Course Coordinator: Dr. T. Chathuranga Bamunuarachchige

Course Name: **Microbial Taxonomy**

Course Code: **MIB 4204** (Theory 22 hrs, Pract. 21 hrs, IL 37 hrs)

Course Capsule: Place for archeae, bacteria and fungi in three-domain and five-kingdom classification and in phylogeny, Taxonomy vs classification vs identification, Nomenclature: International Code of Nomenclature of Bacteria (ICNB) and Beygey's manual, International Code of Botanical Nomenclature (ICBN); Phylogenetic relationships of prokaryotes, Phylogenetic relationships of fungi and fungi-like organisms, Characteristics used for identification of bacteria: Structural, biochemical, physiological and serological properties, genetic relatedness (base composition, DNA melting curve, nucleic acid hybridization, DNA sequencing, signature sequences);Major groups of prokaryotes, Fungal nomenclature and classification, Fungi and Fungi-like organisms, Fungal genomics and taxonomy, Methods in fungal taxonomy

Course Aim: To introduce complex nature and codes governing taxonomy and nomenclature of microorganisms, phylogenetic relationships among prokaryotes and among fungi and fungi-like organisms, methodologies used for taxonomy, nomenclature and identification of microorganisms

Course ILOs: At the end of the course, the student should be able to

1. explain the taxonomic position of prokaryotes and fungi in phylogeny
2. identify important features of taxonomic interest in prokaryotes and fungi
3. describe the methods used in microbial taxonomy and phylogenetic studies and their limitations
4. compare and contrast different strategies used in taxonomy, nomenclature and identification of microorganisms
5. distinguish fungi from fungi-like organisms
6. interpret the concepts in fungal taxonomy
7. perform identification of a bacteria and fungi to species level

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: No field visits outside the University

Assessment Strategy:

Continuous assessment		- 50%
	Essays	- 20%,
	Mid- semester and class test	- 10%
	Presentations	- 20%
End semester assessment		- 50 %

References:

1. J Chun and FA Rainey (2014) Integrating genomics into the taxonomy and systematics of the Bacteria and Archaea. International Journal of System and Evolution Microbiol 64, 316-324 (DOI 10.1099/ijs.0.054171-0)
2. JK Misra, JP Tewari and SK Deshmukh (2012) Systematics and evolution of fungi. CRC Press.
3. L Margulis and M Chapman (2010) Kingdoms and domains: An Illustrated guide to the phyla of life on earth. Academic Press (570.12MAR)
4. HL Barnett (2010) Illustrated genera of impacted fungi, Amer. Phytopathol. Soc. (579.5 BAR)
5. Bergey's manual systematic bacteriology Vols 2 and 3 (2005, 2009) Springer (579BER.)
6. JG Holt, NR Krieg, PHA Sneath, JT Stanley and ST Williams(2000) Bergey's manual of determinative bacteriology. Williams & Wilkins, Baltimore (579.3BER)
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Mr. Gayan D Abeysinghe (email: gayandak1@gmail.com, Tel: 0715601760)

Course Coordinator: Prof. Sanath Hettiarachi

Course Name: **Techniques and Strategies in Molecular Biology**

Course Code: **MIB 4205** (Theory 26 hrs, Pract. 12 hrs, IL 42 hrs)

Course Capsule: Concepts of throughput and resolution, Blotting and *in situ* hybridization, High resolution live cell imaging, DNA sequencing; Sanger sequencing, pyro-sequencing and next generation sequencing , DNA synthesis, genome editing, Directed mutagenesis & protein engineering, Tools for DNA methylation analysis, DNA libraries, Expression profiling, Proteomics, Protein sequencing, Tools for protein-protein interactions and PTM analysis

Course Aim: Course aims to provide students with an advanced understanding of the strategies and techniques used in molecular biology relevant to the biotechnology industry and to advanced molecular biology research.

Course ILOs: At the end of the course the student should be able to

1. describe applications of techniques used in molecular biology while appreciating the innovative nature of those
2. develop probes for blotting techniques
3. compare and contrast different strategies used in DNA sequencing and DNA synthesis
4. illustrate relationship between directed mutagenesis and protein engineering
5. Design primers for analysis of DNA methylation
6. Evaluate importance and limits of gene libraries and expression profiling
7. justify the need for protein-protein interaction studies
8. construct DNA libraries

Resource Requirements: Handouts, Multimedia, computers, laboratories, lecture theatres,

Transport Requirements: No field visits

Assessment Strategy:

Continuous assessment		-50%
Essays	-20%,	
Mid- semester and class test	-10%	
Presentations	-20%	
End semester assessment		-50 %

References:

1. H Miller, D Scott and S Carson (2011) Molecular biology techniques: A classroom laboratory manual 3rd ed. Academic Press
2. An Overview of Northern and Southern Blotting. https://intranet.pasteur.edu.uy/publico/bonilla/Protocolos/Temas/An%20Overview%20of%20Northern%20and%20Southern%20Blotting.pdf
3. Mahmood T and P-C Yang (2012) Western Blot: Technique, Theory, and Trouble Shooting N Am J Med Sci. 4(9): 429–434. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3456489/
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8. Journal of Biotechniques, USA

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Course Coordinator: Dr. T. Chathuranga Bamunuarachchige

Course Name: **Molecular Biotechnology**

Course Code: **MIB 4206** (Theory 26 hrs, Pract. 12 hrs and IL 42 hrs)

Course Capsule: **Fundamentals:** Recombinant technology, synthesis, sequencing and amplification of DNA, manipulation of gene expression, **Medical biotechnology:** molecular diagnostics, therapeutics, novel vaccines, MABs; introduction and applications, SABs and applications, gene therapy and stem cell therapy. **Agricultural and environmental biotechnology:** bioremediation and biomass utilization, transgenics and micropesticides, **Food biotechnology:** commercial production of fructose and alcohol; improvements, synthesis of L- Ascorbic acid and amino acids. Intellectual property rights and patenting

Course Aim: Molecular Biotechnology is responsible for transforming discoveries of life sciences into industrial products, processes and techniques that can serve the needs of society. Hence, it is the hub of biotechnology that translates the research and development to the industries. Students following this course will have the knowledge and skills to understand the fundamental bioprocess research and relate it to the relevant industries.

Course ILOs: At the end of this course, students should be able to

1. list and explain tools of molecular biotechnology
2. apply tools of molecular biotechnology to solve real life problems
3. design molecular techniques to diagnose a given disease
4. critically evaluate microbial pesticide usage in sustainable agriculture
5. compare and contrast transformation techniques
6. critically evaluate transgenics as means of improving living conditions of humans
7. propose detection methods for a given GMO
8. design a risk assessment protocol for a given transgenic
9. explain new developments in Food Biotechnology
10. describe the need for intellectual property rights

Resource Requirements: Handouts, Multimedia, computers, interactive whiteboard, video camera, live specimens, Molecular Biology, Microbiology& Plant tissue culture laboratories, Interactive lecture theatre and lecture theatres, planthouse.

Transport Requirements: Vehicle for ten people to visit Human Genetics Unit, Faculty of Medicine, University of Colombo

Assessment Strategy:

Continuous assessment – 40%:

Quiz	- 10%
Problem solving activities	- 20%,
Viva	- 10%

End semester assessment –60%:

Theory	- 50%
Practicals	- 10%

References:

1. CA Dhelinger (2014) Molecular Biotechnology. Jones and Bartlet Learning, USA.
2. BR Glick and JJ Pasternack (2009) Molecular biotechnology; Principles and Applications of Recombinant DNA 4th ed. Washington, DC: ASM press.
3. TA Brown (2010). Gene cloning 6th ed. Blackwell Science, USA.
4. Journal of Biotechnology, Springer, USA.
5. Journal of Biotechniques, USA.

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Course Coordinator: Dr T. Chathuranga Bamunuarachchige

Course Name: **Microbial Genetics**

Course Code: **MIB 4207** (Theory 24hrs, Pract. 16 hrs (Incl. field Visit) and IL 40 hrs)

Course Capsule: Genome vs. cell size: prokaryotes and eukaryotes, Bacterial DNA transfer; Natural transformation, Transduction & Conjugation; Extra-intrachromosomal elements: Plasmids, IS elements, Transposons, Integrons & Mu elements; Control of gene expression: Gene regulation in prokaryotes & eukaryotes, Homologous recombination; Bacterial & eukaryotic , Genetics of Differentiation: Fruiting in Myxobacteria, Heterocyst development in Cyanobacteria; Protein Phosphorylation: hexose phosphate transportation, Nitrogen & Phosphate regulation; Fungal genetics: Yeast genetics and Genomic elements, Tetrad analysis; Viral genetics: lytic cycle and lysogenic cycle; Genetics of Achaea.

Course Aim: To elaborate on fundamental concepts and principles of microbial genetics, familiarizing important and well established concepts in microbial genetics, while emphasizing the latest discoveries that have emerged to pave way for research in genetics and logical thinking when analyzing and solving scientific problems in microbial genetics.

Course ILOs: At the end of this course, students should be able to

1. explain the relationship between genome and the cell size of prokaryotes and eukaryotes
2. describe and demonstrate processes of bacterial DNA transfer
3. rationalize the need to acquire DNA
4. critically evaluate the importance of plasmids
5. compare different mobile elements of genomes
6. compare and contrast gene regulation mechanisms of prokaryotes with that of eukaryotes
7. explain mechanisms of homologous recombination
8. describe genetics of differentiation citing examples
9. propose mechanisms of phospho-regulation based gene expression
10. describe and compare salient genetic features of different microbial systems

Resource Requirements: Handouts, Multimedia, computers, interactive whiteboard, video camera, Molecular Biology & Microbiology laboratories, Interactive lecture theatre and lecture theatres,

Transport Requirements: Vehicle for ten people to visit Human Genetics Unit, Faculty of Medicine, University of Colombo

Assessment Strategy:

Continuous assessment	- 40%:
Quiz	- 7.5%
Individual poster session	- 15%
Student presentation	- 7.5%
Viva	- 10%
End semester assessment	- 60%:
End term paper	- 50%
Practical spot test	- 10%

- Weeks 1-5 will be used to generate the quiz (Midterm).
- Weeks 7-13 will be used to develop viva questions
- IP: topics will be generated for individual posters

A model paper as a tutorial will be given to sense the end term paper with respect to structure. Model answers will be provided to familiarize how to handle ILOs tested at the end term.

References:

Books

1. L Snyder, JE Peters, TM Henkin and W Champness (2013)Molecular Genetics of Bacteria, 4th ed. ASM press, USA.
2. S Shrivastava (2013) Genetics of bacteria, Springer.
3. K Chaudhari (2013) Microbial Genetics, TERI.
4. R Schneiter (2004) Genetics, Molecular and Cell Biology of Yeast, University of Freiburge, Switzerland
5. D Moore and LA Novak Frazer (2002) Essential fungal genetics. Springer
6. https://www.unifr.ch/biochem/assets/files/schneiter/cours/Yeast/YeastGenetics.pdf

Journals

1. BMC Microbiology, Springer, USA.
2. Journal of Applied Genetics, Springer, USA.

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Course Coordinator: Dr. T. Chathuranga Bamunuarachchige

Annexure- Table 4: Course contribution to Program Outcome (Graduate Profile)

	Course Code	Course name	K%	S%	A%	M%
First Year						
1	BOT 1201	Plant Diversity	36.6	25.1	26.8	13.4
2	BOT 1202	Functional Plant Anatomy and Wood Science	38	26.1	31.4	9.7
3	BOT 1203	General Microbiology	43.1	19.1	33	10.2
4	ZOO 1201	Invertebrate Diversity	26.7	13.4	46.7	13.3
5	ZOO 1303	Vertebrate Diversity	40.7	22.2	25.9	11.1
6	ZOO 1104	Laboratory Techniques in Zoology	26.3	18.3	49.9	15.8
7	BIO 1201	Cell Biology & Biochemistry	43.3	17.3	26.1	13
8	BIO 1202	Statistical Methods in Biology	52.3	28.6	14.3	11.1
9	IDC 1201	Philosophy of Science	33.4	25.1	31.4	20.8
	First Year Contribution to Graduate profile		**37.8**	**21.6**	**27.3**	**13.2**
Second Year						
1	BOT 2201	Plant Physiology	35.5	22.8	25.4	16.5
3	BOT 2203	Flora of Sri Lanka	51.3	17	26.9	4.8
4	BOT 2202	Plant Pathology	40.2	25.4	23.7	10.7
5	ZOO 2201	Animal Histology and Physiology	53.9	18	17.9	10.3
6	ZOO 2202	General Entomology	38.3	29.5	26.5	5.9
7	ZOO 2203	Animal Behaviour	30.1	27.5	31.5	10.9
8	ZOO 2204	Fish Biology	40	30	24	6
9	BIO 2201	Systematic Biology	35.8	25.8	21.7	16.7
10	BIO 2302	Principles of Ecology	27.3	30.1	31.5	11.2
11	BIO 2203	Genetics and Evolution	30.3	26.2	31.5	12.6
12	IDC 2202	Scientific Communication	25.3	28.3	34.4	12.2
13	IDC 2203	Principles and Practices of Marketing	32.5	31.3	29.1	7.5
	Second Year Contribution to Graduate Profile		**36.7**	**26.1**	**27.0**	**10.4**
Third Year						
1	BOT 3201	Plant Tissue Culture	32.4	30.9	21.6	15.4
2	BOT 3202	Principles and Practice of Horticulture and Landscaping	22.3	29.6	33.5	14.8
3	BOT 3203	Postharvest Technology of Plant Products	41.3	28.2	21.6	8.7
4	BOT 3204	Economic Botany	50.6	19.8	9.9	11
5	ZOO 3201	Medical Entomology	37.2	28.6	25.8	8.6

6	ZOO 3202	Applied Parasitology	38.5	29.4	24.9	6.8
7	ZOO 3203	Economic Entomology	39.7	26.3	20.8	13.2
8	ZOO 3204	Embryology and Developmental Biology	38	36.9	23.8	1.1
9	BIO 3201	Molecular Biology	42.8	39.7	9.6	7.9
10	BIO 3102	Ecotourism	29	30.1	28.8	12.6
11	BIO 3203	Environmental Pollution	29.2	36.1	23.2	11.7
12	BIO 3204	Bioinformatics	40.4	32.4	17.6	9.7
13	BIO 3205	Ecotoxicology	29.3	29.3	30.7	10.8
14	BIO 3206	Experimental Design and Nonparametric Methods in Statistics	52.3	28.6	14.3	11.1
15	BIO 3207	Field Project in Biology	32.3	37.9	22.4	7
16	BDC 3301	Concepts of Biodiversity Conservation	28.8	39.5	20.9	10.5
17	BDC 3202	Environmental Impact and Risk Assessment	30.4	29.5	31.2	8.6
18	BDC 3203	Introduction to GIS	28.9	32.2	28.9	10
19	BDC 3204	Wildlife Management and Conservation	29.4	30.6	29.3	10.3
20	FAM 3201	Fisheries and Aquaculture	44	20.7	23.3	12.1
21	FAM 3302	Breeding Techniques in Aquaculture	28.2	30.6	30.6	10.2
22	FAM 3303	Ornamental Fishery	27.6	31.2	31.2	10.4
23	MIB 3201	Industrial Microbiology	37.3	31.5	21	10.5
24	MIB 3202	Soil Microbiology	35.2	32.5	15.1	17.6
25	MIB 3203	Virology	23.7	31.2	18	12.3
26	MIB 3204	Food Microbiology	35.3	29.4	24.6	10.6
27	MIB 3205	Plant-Microbe Interactions	35.7	27.2	24.4	12.8
28	IDC 3201	Entrepreneurship Development	28.5	32.2	30.3	9.4
29	IDC 3202	Standards and Quality Management Systems	36.4	23.4	23.4	16.9
	Third Year Contribution to Graduate Profile		**34.6**	**30.5**	**23.5**	**10.8**
Graduate Profile (Three year Degree)			**36.4**	**26.1**	**25.9**	**11.5**

Contribution to Graduate Profile (B.Sc. in Applied Sciences)

First Year	K-37.9	S-21.7	A-27.3	M-13.2
Second Year	K-36.7	S-26.1	A-27.0	M-10.4
Third Year	K-34.6	S-30.5	A-23.5	M-10.8
TOTAL	K-36.4	S-26.1	A-25.9	M-11.5

B.Sc. Honours in Applied Biology (Biodiversity Conservation)

	Course Code	Course name	K%	S%	A%	M%
Third Year						
1	BOT 3201	Plant Tissue Culture	42.8	39.7	9.6	7.9
2	ZOO 3201	Medical Entomology	37.2	28.6	25.8	8.6
3	ZOO 3203	Economic Entomology	39.7	26.3	20.8	13.2
4	ZOO 3204	Embryology and Developmental Biology	38	36.9	23.8	1.1
5	BIO 3201	Molecular Biology	42.8	39.7	9.6	7.9
6	BIO 3102	Ecotourism	29	30.1	28.8	12.6
7	BIO 3203	Environmental Pollution	29.2	36.1	23.2	11.7
8	BIO 3205	Ecotoxicology	29.3	29.3	30.7	10.8
9	BIO 3206	Experimental Design and Nonparametric Methods in Statistics	33.5	25.7	26.8	13.4
10	BIO 3207	Field Project in Biology	0	0	0	0
11	BDC 3301	Concepts of Biodiversity Conservation	28.8	39.5	20.9	10.5
12	BDC 3202	Environmental Impact and Risk Assessment	30.4	29.5	31.2	8.6
13	BDC 3203	Introduction to GIS	28.9	32.2	28.9	10
14	BDC 3204	Wildlife Management and Conservation	29.4	30.6	29.3	10.3
15	IDC 3201	Entrepreneurship Development	28.5	32.2	30.3	9.4
16	IDC 3202	Standards and Quality Management Systems	36.4	23.4	23.4	16.9
	Third Year Contribution to Graduate profile		**33.7**	**32**	**24.3**	**10**
Fourth Year						
1	BDC 4201	Environmental Policies and Management	33.4	35.4	23.1	8.4
2	BDC 4202	Wetland Conservation and Management	34.2	35.5	16.5	13.9
3	BDC 4203	Forest Conservation	29.7	30.5	31.3	8.6
4	BDC 4204	Advanced Geographical Information Systems	26.6	46.8	21	5.5
5	BDC 4205	Economics of Biodiversity	28.9	37.1	27.9	6.2
6	BDC 4206	Aquatic Resources & Conservation	40	25.3	25.3	9.3
7	BDC 4207	Coastal and Marine Biodiversity Conservation	34.7	32.6	24.5	8.1
8	BDC 4208	Current Topics in Biodiversity Conservation	27.9	32.6	25.7	14
9	BDC 4209	In plant Training	23.5	33	31.4	12.6
10	BDC 4810	Research Project	26.6	30.8	30.8	11.2
	Fourth Year Contribution to Graduate Profile		**30.5**	**34.0**	**25.7**	**9.8**
	Graduate Profile (B.Sc. Honours in Biodiversity Conservation)		**32.1**	**33**	**25**	**9.9**

B.Sc. Honours in Fisheries and Aquaculture Management

	Course Code	Course name	K%	S%	A%	M%
Third Year						
1	BOT 3201	Plant Tissue Culture	42.8	39.7	9.6	7.9
2	ZOO 3202	Applied Parasitology	22.3	29.6	33.5	14.8
3	ZOO 3204	Embryology and Developmental Biology	38	36.9	23.8	1.1
4	BIO 3201	Molecular Biology	42.8	39.7	9.6	7.9
5	BIO 3203	Environmental Pollution	29.2	36.1	23.2	11.7
6	BIO 3205	Ecotoxicology	29.3	29.3	30.7	10.8
7	BIO 3206	Experimental Design and Nonparametric Methods in Statistics	33.5	25.7	26.8	13.4
8	BDC 3203	Introduction to GIS	28.9	32.2	28.9	10
9	FAM 3201	Fisheries and Aquaculture	44	20.7	23.3	12.1
10	FAM 3302	Breeding Techniques in Aquaculture	28.2	30.6	30.6	10.2
11	FAM 3303	Ornamental Fishery	27.6	31.2	31.2	10.4
12	MIB 3204	Food Microbiology	35.3	29.4	24.6	10.6
13	IDC 3201	Entrepreneurship Development	28.5	32.2	30.3	9.4
14	IDC 3202	Standards and Quality Management Systems	36.4	23.4	23.4	16.9
	Third Year Contribution to Graduate profile		33.3	31.2	25	10.5
Fourth Year						
1	FAM 4201	Fishery Resources Management	27.2	31.2	31.2	10.4
2	FAM 4202	Aquaculture engineering	27.5	31.2	31.2	10.4
3	FAM 4203	Aquafarming of Macrophytes	32	32.7	27	9
4	FAM 4204	Fish nutrition and Growth	35.5	30.2	25.8	8.6
5	FAM 4205	Fish health Management	35.4	27.6	27.6	9.2
6	FAM 4206	Postharvest Techniques in fisheries	28.5	25.8	34.2	11.4
7	FAM 4207	Fishery Economics	28.5	30.6	30.6	10.2
8	FAM 4208	Current Topics in Fisheries and Aqua. Manag.	27.9	32.6	25.7	14
9	FAM 4209	In plant Training	23.5	33	31.4	12.6
10	FAM 4810	Research Project	26.6	30.8	30.8	11.2
	Fourth Year Contribution to Graduate Profile		**29.3**	**30.6**	**29.6**	**10.7**
	Graduate Profile (B.Sc. Honours in Fisheries and Aquaculture management)		**31.3**	**30.9**	**27.3**	**10.6**

B.Sc. Honours in Microbiology

Course Code		Course name	K%	S%	A%	M%
Third Year						
1	BOT 3203	Postharvest Technology of Plant Products	41.3	28.2	21.6	8.7
2	BIO 3201	Molecular Biology	42.8	39.7	9.6	7.9
3	BIO 3203	Environmental Pollution	29.2	36.1	23.2	11.7
4	BIO 3204	Bioinformatics	40.4	32.4	17.6	9.7
5	BIO 3205	Ecotoxicology	29.3	29.3	30.7	10.8
6	BIO 3206	Experimental Design and Nonparametric Methods in Statistics	33.5	25.7	26.8	13.4
7	MIB 3201	Industrial Microbiology	37.3	31.5	21.0	10.5
8	MIB 3202	Soil Microbiology	35.2	32.5	15.1	17.6
9	MIB 3203	Virology	27.4	36.8	21.7	14.2
10	MIB 3204	Food Microbiology	35.3	29.4	24.6	10.6
11	MIB 3205	Plant Microbial Interactions	35.7	27.2	24.4	12.8
12	MIB 3206	Analytical Techniques in Biology	31.1	32.9	24.6	11.5
13	MIB 3207	Immunology	38.6	34.0	16.6	11.0
14	MIB 3208	Environmental Microbiology	31.9	33.6	24.7	9.7
15	IDC 3201	Entrepreneurship Development	28.5	32.2	30.3	9.4
16	IDC 3202	Standards and Quality Management Systems	36.4	23.4	23.4	16.9
	Third Year Contribution to Graduate profile		**34.6**	**31.6**	**22.2**	**11.7**
Fourth Year						
1	MIB 4201	Applied Mycology	32.5	25.5	27.0	15.1
2	MIB 4202	Medical Microbiology	38.2	30.3	16.9	14.4
3	MIB 4103	Molecular Microbiology	34.2	31.5	22.5	11.7
4	MIB 4204	Microbial Taxonomy	34.5	29.5	21.3	14.8
5	MIB 4205	Techniques and Strategies in Molecular Biol.	36.9	36.1	15.9	11.4
6	MIB 4206	Molecular Biotechnology	28.7	33.0	27.8	10.2
7	MIB 4207	Microbial Genetics	35.2	37.7	16.8	10.6
8	MIB 4208	Current Topics in Microbiology	27.9	32.6	25.7	14.0
9	MIB 4209	In plant training	23.5	33.0	31.4	12.6
10	MIB 4810	Research Project	26.6	30.8	30.8	11.2
	Fourth Year Contribution to Graduate Profile		**31.8**	**32.0**	**23.6**	**12.6**
	Graduate Profile (B.Sc. Honours in Microbiology)		**33.2**	**31.8**	**22.9**	**12.1**