RANI CHANNAMMA UNIVERSITY, BELAGAVI

RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS
as per the Choice Based Credit System (CBCS) designed in accordance with
Learning Outcomes-Based Curriculum Framework (LOCF)
of National Education Policy (NEP) 2020
for

Bachelor of Science (Botany)

w.e.f.

Academic Year 2021-22 and onward

Board of Studies (UG) Committee

(NEP-Bachelor of Science)

Bachelor of science (Botany) Programme 2021-22

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PREAMBLE

The objective of a B.Sc. (Honors) programme in Higher Education system is to prepare its students for the society. The current pattern is designed to provide a focused learning outcome-based syllabus at the Honors level providing structured teaching-learning experiences catering to the needs of the students. The honors courses will prepare the students both academically and in terms of employability. The programme also inculcates various attributes at the Honors level. These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for

continuous learning and sustainability. The new curriculum based on learning outcomes of BSc (Honours) Botany offers knowledge of areas including Plant Systematics, Plant Biotechnology, Resource Botany, Genetics, Ecology, Conservation biology, Physiology and Bioinformatics, Medicinal plants, Plant diseases management etc. The courses define clearly the objectives and the learning outcomes, enabling students to choose the elective subjects broadening their skills in the field of Botany. The course also offers skills to pursue research and teaching in the field of Botany and thus would produce best minds to meet the demands of society This curriculum framework for the bachelor-level program in Botany is developed keeping in view of the student-centric learning pedagogy, which is entirely outcome-oriented and curiosity-driven. To avoid a rote-learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts. The curriculum framework focuses on the pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works.

Aims of Bachelor's degree programme in Botany

The broad aims of the bachelor's degree programme in Botany are:

1. To provide an environment that ensures the cognitive development of students in a holistic manner. A dialogue about plants and their significance is fostered in this framework, rather than didactic monologues on mere theoreticalaspects
2. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-relatedemployment.
3. To mould a responsible citizen who is aware of the most basic domain-independent knowledge, including critical thinking andcommunication.
4. To enable the graduate to prepare for national as well as international competitive examinations, especially UGC-CSIR NET, and UPSC Civil ServicesExamination.

Program Learning Outcomes

The students graduating with the Degree B.Sc. Three years and B. Sc. (Honors) Botany should be able toacquire.

Core competency: Students will acquire core competency in the subject Botany, and allied subject areas.

1. The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms)plants.
2. Students will be able to use the evidence-based comparative botany approach to explain the evolution of organisms and understand the genetic diversity on the earth. The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome, and how organism's function is influenced at the cell, tissue, and organ level.

3. Students will be able to understand the adaptation, development, and behavior of different forms oflife.
4. The understanding of networked life on earth and tracing the energy pyramids through nutrient flow is expected from thestudents.
5. Students will be able to demonstrate the experimental techniques and methods of their area of specialization inBotany.

Analytical ability:

The students will be able to demonstrate the knowledge in understanding research and addressing practicalproblems.

1. Application of various scientific methods to address different questions by formulating the hypothesis, data collection, and critically analyze the data to decipher the degree to which their scientific work supports theirhypothesis.

Critical Thinking and problem-solving ability:

An increased understanding of fundamental concepts and their applications of scientific principles is expected at the end of this course. Students will become critical thinkers and acquire problem-solving capabilities.

Digitally equipped:

Students will acquire digital skills and integrate the fundamental concepts with modern tools.

Ethical and Psychological strengthing: Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.

Team Player: Students will learn team workmanship in order to serve efficiently institutions, industry, and society.

Independent Learner: Apart from the subject-specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitiveexaminations,andemployment.Learningoutcomes-basedcurriculumwouldensure

equal academic standards across the country and a broader picture of their competencies. The Bachelor's program in Botany and Botany honors may be mono-disciplinary or multidisciplinary with following broad objectives.

1. Critically evaluation of ideas and arguments by collecting relevant information about the plants, to recognize the position of the plant in the broad classification and phylogenetic level.
2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.
3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of the plant in taxonomy.
4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports theirhypotheses.
5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicingscientists.
6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of theseworks.
7. Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biologicalsituations.
8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and other forms oflife.

9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and lifehistory.
10. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, andecosystems
11. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization withinbiology.

B. Sc. Botany Course outcomes under NEP program

The framework of curriculum for the Bachelor's program in Botany aims to transform the course content and pedagogy to provide a multidisciplinary, student-centric, and outcome-based, holistic education to the next generation ofstudents.

Aside from structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels; keeping in mind the job prospects; the emphasis has been to maintain academic coherence and continuum throughout the program of study and help build a strong footing in the subject, thereby ensuring a seamless transition into theircareers.

Special attention is given to eliminate redundancy, discourage rote learning, and espouse a problem-solving, critical thinking, and inquisitive mindset among learners.

The curriculum embraces the philosophy that science is best learned through experiential learning, not limited to the confines of a classroom but rather through hands-on training, projects, field studies, industrial visits, andinternships.

This updated syllabus, with modern technology, helps students stay informed on the leading- edge developments in plant sciences and promotes curiosity, innovation, and a passion for research, that will serve them well in their journey into scientific adventure and discovery beyondgraduation.

The goal is to equip students with holistic knowledge, competencies, professional skills, and a strong positive mindset that they can leverage while navigating the current stiff challenges of the job market.

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome based education (OBE) for details on Program Outcomes)

PO1: Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.

PO2: Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.

PO3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

PO4: Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.

PO5: Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

PO6: Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

PO7: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..

PO8: Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

PO 9: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC etc.

PO10: To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

PO 11: The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies etc at the right opportunity.

PO 12: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career.

RANI CHANNAMMA UNIVERSITY
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Curricular and Credits Structure under Choice Based Credit System [CBCS] of Botany Major& One Minor Discipline Scheme for the Four Years Computer Science B.Sc. Undergraduate Honors Programmewith effect from 2021-22

SEMESTER-I										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	2
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	2
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1BOT1L	Microbial Diversity and technology	40	60	100	4	-	-	4	2
	21BSC1BOT1P	Microbial Diversity and technology	25	25	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC1	21BSC1SE1CS1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education- Yoga	25	-	25	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC1	21BSC1BOT1	Plants and Humanwelfare	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	
SEMESTER-II										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	

			IA	SEE	Total	L	T	P		Duration of exams (Hrs)
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2BOT2L	Diversity of Non flowering plants	40	60	100	4	-	-	4	2
	21BSC2BOT2P	Diversity of Non flowering plants	25	25	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	20	30	50	3	-	-	2	2
VBC3	21BSC2V3PE2	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BSC2BOT2	Bio-fuels	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	
Exit option with Certificate (with the completion of courses equal to a minimum of 48 credits)					**1400**				**50**	

SEMESTER-III

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC2BOT3L	Plant Anatomy and Developmental Biology	40	60	100	4	-	-	4	2
	21BSC2BOT3P	Plant Anatomy and Developmental Biology	25	25	50	-	-	4	2	3
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3			40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	

SEMESTER-IV

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2

	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	2
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC2BOT4L	Ecology and Conservation Biology	40	60	100	4	-	-	4	2
	21BSC2BOT4P	Ecology and Conservation Biology	25	25	50	-	-	4	2	3
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
AECC2	21BSC4AE1CI2	Constitution of India	20	30	50	3	-	-	2	2
VBC7	21BSC4V5PE4	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC4			40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	
Exit option with Diploma in Science (with the completion of courses equal to a minimum of 96 credits)OR continue studies with Major and Minor					**2800**				**100**	

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Botany as Major Discipline										

DSC5	21BSC2BOT5L	Plant Taxonomy & Resource Botany	40	60	100	3	-	-	3	2
	21BSC2BOT5P	Plant Taxonomy & Resource Botany	25	25	50	-	-	4	2	3
DSC6	21BSC2BOT6L	Cell Biology and Genetics	40	60	100	3	-	-	3	2
	21BSC2BOT6P	Cell Biology and Genetics	25	25	50	-	-	4	2	3
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	3
VC1	21BSC5VC1US	Unix & Shell Programming	40	60	100	3	-	-	3	2
	21BSC5VC1FD	Fundamentals of Data Science								
VBC9	21BSC5V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC10	21BSC5V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BSC5SE3CS3	Cyber Security	25	25	50	1	-	2	2	2
Total Marks					**650**	**Semester Credits**			**22**	

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Botany as Major Discipline										
DSC7	21BSC2BOT7L	Plant Physiology and Biochemistry	40	60	100	3	-	-	3	2

	21BSC2BOT7P	Plant Physiology and Biochemistry	25	25	50	-	-	3	2	3
DSC8	21BSC2BOT8L	Plant Biotechnology	40	60	100	3	-	-	3	2
	21BSC2BOT8P	Plant Biotechnology	25	25	50	-	-	3	2	3
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	3	2	3
VC2	21BSC6VC2HT	Health Care Technologies	40	60	100	3	-	-	3	2
	21BSC6VC2DM	Digital Marketing								
INT1	21BSC6 INT1L	Internship*	25	50	75	-	-	-	2	2
VBC1	21BSC6V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC2	21BSC6V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BSC6SE4CS4	Professional Communication	25	25	50	1	-	2	2	2
Total Marks					**700**		**Semester Credits**		**24**	
Exit with Bachelor of Science Degree, B. Sc. (with the completion of courses equal to a minimum of 140 credits)or continue studies with the Major					**4175**		**Total Credits for BSC Program**		**146**	

*Internship between 5 th& 6th Semester with 3 to 4 weeks

Botany Subject as a Minor Discipline

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC5 As a Minor Subject	21BSC2BOT5L	Plant Taxonomy & Resource Botany	40	60	100	3	-	-	3	2

	21BSC2BOT5P	Plant Taxonomy & Resource Botany	25	25	50	-	-	3	2	3

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC6 As a Minor Subject	21BSC2BOT7L	Plant Physiology and Biochemistry	40	60	100	3	-	-	3	2
	21BSC2BOT7P	Plant Physiology and Biochemistry	25	25	50	-	-	3	2	3

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of **B.Sc**. **Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).**
5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. **OEC: For non- Botany science students. Botany Science students have to opt for OEC from departments other than major and minor disciplines.**

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit, &Language Urdu
7. Code 1: Course in that semester.
8. Bot: Botany

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY

Department of Botany

BSc(botany)

Sub: Code: Maximum Marks: 60

a. Answer any Six Questions from Question 1 b. Answer any Three each Questions from Question 2,3,4 and 5

Q.No.1.	Answer any Six Questions (Atlest Two question from Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit-I) a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III) a. b. c. d.	4X3=12
Q.No.5.	(Should cover Entire Unit-IV) a. b. c. d.	4X3=12

COURSE-WISE SYLLABUS

Semester I

Year	I	**Course Code:** 21BSC1BOT1L **Course Title:** Microbial diversity and Technology	**Credits**	04
Sem.	1		**Hours**	52
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	
Course Outcomes		1. Understand the fascinating diversity, evolution, and significance ofmicroorganisms. 2. Comprehend the systematic position, structure, physiology and life cycles of		

	microbes and their impact on humans andenvironment. 3. Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research andindustry.	
Unit No.	**Course Content**	**Hours**
Unit I	**Chapter No. 1:** Microbial diversity-Introduction to microbial diversity; Hierarchical organization and positions of microbes in the living world. Whittaker's five-kingdom system . Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature. **5 Hours** **Chapter No. 2** History and developments of microbiology-Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, SergiusWinogradsky and M W Beijerinck and Paul Ehrlich).**3 Hours** **Chapter No. 3** Microscopy-Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram's and differential staining. **5 Hours**	13
Unit II	**Chapter No. 4.** Culture media for Microbes-Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media. **3 Hours** **Chapter No. 5**. Sterilization methods -Principle of disinfection, antiseptic, tyndallisation and Pasteurization, Sterilization-Sterilization by dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents. **5 Hours** **Chapter No. 6**. Microbial Growth-Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs. **5 Hours**	13
Unit III	**Chapter No. 7** Microbial cultures and preservation-Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture	13

	collections and their importance. A brief account on ITCC, MTCC and ATCC. **5 Hours** **Chapter No. 8. Viruses-** General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types. **5 Hours** **Chapter No. 9. Viroids**- general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases**.** Economic importance of viruses. **3 Hours**	
Unit IV	**Chapter No. 10. Bacteria-** General characteristics and classification. Archaebacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of *Rhizobium* and its applications. A brief account of Actinomycetes and Cyanobacteria. Mycoplasmas and Phytoplasmas- Generalcharacteristics and diseases. Economic importance of Bacteria. **5 Hours** **Chapter No. 11. Fungi-**General characteristics and classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of *Phytophthora, Rhizopus,,Puccinia, Penicillium***.** **5 Hours** **Chapter No. 12. Lichens –** Structure and reproduction. **VAM Fungi** and their significance. **Fungal diseases**-. Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Citrus Canker, Economic importance of Fungi. **3 Hours**	13
Recommended Leaning Resources		

Print Resources	**Text Books** 1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman ltd. New Delhi. 2. Arora DR. 2004. Textbook of Microbiology, CBS, NewDelhi. 3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York. 4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, NewDelhi. 5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi. 6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp. 7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India. 8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi. **References** 1. Alexepoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., NewDelhi. 2. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. NewYork. 3. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffts. N.J.Prentice- Hall. NewDelhi. 4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge UniversityPress.Cambridge. 5. Michel J, Pelczar Jr.EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, New Delhi. 6. Powar CB and Daginawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishinghouse,Bombay. 7. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp. 8. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. NewDelhi

Year	I	**Course Code:** 21BSC1BOT1P **Course Title:**Microbial diversity and Technology	**Credits**	02
Sem.	I		**Hours**	45

Course Pre-requisites, if any:	NA	
Formative Assessment Marks: 25	Summative Assessment Marks: 25	Duration of ESA: 03 hrs.

Practical 1: Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, Laminar flow hood, Colony counter, Haemocytomer, Micrometer etc.).

Practical 2: Enumeration of soil/food /seed microorganisms by serial dilution technique.

Practical 3: Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of E coli / B. subtilis/ Fungi and study of cultural characteristics.

Practical 4: Determination of cell count by using Hemocytometer and determination of microbial cell dimension by using Micrometer.

Practical 6: Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

Practical 7: Isolation and study of morphology of Rhizobium from root nodules of legumes

Practical 8: Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

Practical 9: Study of vegetative structures and reproductive structures - Albugo,Phytophthora/Pythium, Rhizopus/Mucor, Saccharomyces, , Puccinia, Agaricus, Lycoperdon, Aspergillus/Penicillium.

Practical 10: Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.

Practical 11: Downy mildew of Bajra/Maize/Sorghum, Citrus canker, Tobacco mosaic disease.

Practical 12: Study of well-known microbiologists and their contributions through charts and photographs.

Practical-13: Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

	(Note: Visit to Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life and submission of study report is compulsory)

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course

Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Preparation	Gram staining	05
Enumeration		05
Identification		05
Comment		05
Viva Voice /Tour report		05
Total		**25**

OPEN-ELECTIVE SYLLABUS :

Year	I	**Course Code:** 21BSC1BOT1 **Course Title: PLANTS AND HUMANWELFARE**	**Credits**	03
Sem.	II		**Hours**	40

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA:.02 hrs.

Course Outcomes	At the end of the course the student should be able to: 1. To make the students familiar with economic importance of diverse plants that offer resourcesto human life. 2. To make the students known about the plants used as-food, medicinal value and also plantsource of different economic value. 3. To generate interest amongst the students on plants importance in day today life, conservation,ecosystem and sustainability.

Unit No.	**Course Content**	**Hours**
Unit I	Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation. **Cereals**: Wheat and Rice (origin, evolution, morphology, post-harvest	10

	processing & uses).Green revolution. Brief account of millets and their nutritional importance.	
Unit II	**Legumes:** General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem. **Cash crops:** Morphology, new varieties and processing of sugarcane, products and by- products of sugarcane industry. Natural Rubber – cultivation, tapping and processing.	10
Unit III	**Spices:** Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom. **Fruits:** Mango, grapes and Citrus (Origin, morphology, cultivation ,processing and uses)	10
Unit IV	**Oils and fats:** General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family & uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications. **Beverages:** Tea, Coffee (morphology, processing&uses)	10
Recommended Leaning Resources		
Print Resources	**Text Books:** 1. Kochhar, S.L. (2012). Economic Botany in Tropics. MacMillan & Co. New Delhi. 2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands:Kluwer Academic Publishers. Netherland. 3. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett- Publishers. Lincoln, United Kingdom	

Semester: II

	I	**Course Code: 21BSC2BOT2L**	**Credits**
	2	**Course Title:Diversity of non flowering plants**	**Hours**

rse Pre-requisites, if any	**NA**	
native Assessment Marks: 40	**Summative Assessment Marks: 60**	**Duration of ESA: 03**

rse omes

After completing this course satisfactorily, a student will be able to:

1. Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes and Gymnosperms.
2. Understand the morphology, anatomy, reproduction and life cycle across Algae, Bryophytes, Pteridophytes and Gymnosperms, and their ecological and evolutionary significance.
3. Obtain laboratory skills/explore non-flowering plants for their commercial applications.

No.	**Course Content**	**Hou**
I	**Chapter No. 1** Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae. **5Hours** **Chapter No. 2** Morphology and reproduction and life-cycles of Nostoc, *Oedogonium*, *Spirogyra*, *Ectocarpus and Batrachospermum*. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins. **5Hours** **Chapter No. 3** Algal cultivation- Cultivation of microalgae-*Spirulina*;Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses. **3 Hours**	1
II	**Chapter No. 4.** Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes. **5 Hours** **Chapter No. 5** Distribution, morphology, anatomy, reproduction and life-cycles of *Riccia*, *Anthoceros*, and *Funaria.* Ecological and economic importance of Bryophytes. Fossil Bryophytes. **3 Hours** **Chapter No. 6. . Pteridophytes**- General characteristics and classification; Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction and life-cycles in Psilotum, *Selaginella*, *Equisetum*, *Pteris*. **5Hours**	1
III	**Chapter No. 7** A brief account of heterospory and seed habit. Stelar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance. **5Hours** **Chapter No. 8. Gymnosperms-** General characteristics. Distribution and classification of	1

	Gymnosperms. Study of the habitat, distribution, habit, anatomy, reproduction and life-cycles in Cycas, Pinus andGnetum. **5 Hours** **Chapter No. 9.** Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines. **3 Hours**	
it IV	**Chapter No. 10. Origin and evolution of Plants:** Origin and evolution of plants through Geological Time scale. **2 Hours** **Chapter No. 11. Paleobotany-** Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating. **6 Hours** **Chapter No. 12.** Fossil taxa- *Rhynia, Lepidodendron,Lyginopteri* Exploration of fossil fuels. BirbalSahni Institute of Paleosciences. 5 Hours	1

Recommended Leaning Resources

urces

Text Books:

Text Books

1) Chopra,G.L.AtextbookofAlgae.Rastogi&Co.,Meerut,Co.,NewDelhi,Depot. Allahabad.
2) Johri, LataanfTyagi, 2012, A Text Book of, Vedam e Books, NewDelhi.
3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. NewDelhi.
4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
5) Sharma, O.P., 2017, AlgaeSingh-Pande-Jain2004-05. A Text Book ofBotany. Rastogi Publication, Meerut.

References

1. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allie plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsievier, London.
4. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.
5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge Unversity Press,

Cambridge.Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
9. Kakkar, R.K. and B.R.Kakkar(1995) The Gymnosperms (Fossils and Living) Central Publishing Hou Allahabad.
10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
11. Lee, R.E., 2008, Phycology, Cambridge Unversity Press, Cambridge. 4th edition.McGraw Hill Publish Co., New Delhi.
12. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allhabad.
13. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allhabad.
14. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot.,Allahabad.Press, Cambridge.
15. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New D
16. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes &Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
17. Smith, G.M. 1971. CryptogamicBotny. Vol.I Algae & Fungi. Tata McGraw Hill Publishing. New Dell
18. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
19. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge UniversityCambridge.

	I	**Course Code: 21BSC2BOT2P** **Course Title:Diversity of Non flowering plants**	**Credits**	**02**
	2		**Hours**	**45**

rse Pre-requisites, if any:	**NA**	
native Assessment Marks: 25	**Summative Assessment Marks: 25**	**Duration of ESA: 03 hrs.**

Practical-1: Study of morphology, classification, reproduction and lifecycle of Nostoc, Oscillatoria.

Practical-2: Study of morphology, classification, reproduction and life-cycle of Oedogonium& Spirogyra, Ectocarpus and Batrachospermum.

Practical-3: Study of morphology, classification, reproduction and life-cycle of Riccia&Anthoceros/ Funaria.

Practical-4: Study of morphology, classification, anatomy, reproduction and life-cycle of Selaginella and Equisetum.

Practical -5: Study of morphology, classification, anatomy, reproduction and life-cycle of Pteris, Azolla/.Psilotum

	Practical -6: Study of morphology, classification, anatomy and reproduction in Cycas. Practical -7: Study of morphology, classification & anatomy, reproduction in Pinus. Practical -8: Study of morphology, classification & anatomy, reproduction in Gnetum. **Practical -9**: Study of important blue green algae causing water blooms in the lakes. **Practical -10**: Preparation of natural media and cultivation of Azolla in artificial ponds. **Practical -11:** Study different algal products and fossils impressions and slides. **Practical-12:** Visit to algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils. (Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Classification and description		10
T.S. of given material		05
Identification		05
Viva Voice /Tour report		05
Total		**25**

OPEN-ELECTIVE SYLLABUS:

Year	I	**Course Code:** 21BSC1BOT2	**Credits**	03
Sem.	II	**Course Title:** Bio-fuels	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. To make the students familiar with Bio-fuel plant species cultivation for commercialexploitation. 2. To make the students known about the Bio-fuel used in automobile industries and solvingfuel problems in feature. 3. To generate interest amongst the students to know the importance of Bio-fuel in day todaylife and economic wellbeing. 1.		

Unit No.	Course Content	Hours
Unit I	Introduction, definition, scope and Importance of Bio-fuel with respect to climate change and environmental issues. Public awareness. Biofuels scenario in India and world. History of Biofuels. Advantages and disadvantages of biofuels. Developmental generation of biofuels: first, second, third and fourth generation of biofuels andpresent status.	10
Unit II	Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance.(Biomass- plant, animal and microbial based waste). Algal biofuel.	10
Unit III	Biodiesel species: *Pongamia pinnata, Simarouba gluca, Jatropha curcas, Azardirachta india, Madhuca indica* and *Callophyllum innophyllum* . Seed harvesting, processing, oil extraction, and characterization.	10
Unit IV	Introduction to biodiesel, bioethanol, biogas and bio hydrogen. Production technology of biofuels (Biodiesel, ehanol and biogas). Quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; Biofuel Policy in Karnataka and India. Biofuel production statistics. Fuel against food security concepts.	10
Recommended Leaning Resources		
Print Resources	**Text Books and References** 1) The Biodiesel Handbook (2005). Jurgen Krahl, Jon Harlan Van Gerpen.AOCS Press. 2) Bioenergy and Biofuels (2017).Ozcan Konur. CRC Press, Taylor & Franci's group. 3) https://mnre.gov.in/biofuels 1.	

RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS
as per the Choice Based Credit System (CBCS) designed in accordance with
Learning Outcomes-Based Curriculum Framework (LOCF)
of National Education Policy (NEP) 2020
for

Bachelor of Science (Botany)

B.Sc III and IV sem

w.e.f.

Academic Year 2022-23 and onwards

PREAMBLE

The objective of a B.Sc. (Honors) programme in Higher Education system is to prepare its students for the society. The current pattern is designed to provide a focused learning outcome-based syllabus at the Honors level providing structured teaching-learning experiences catering to the needs of the students. The honors courses will prepare the students both academically and in terms of employability. The programme also inculcates various attributes at the Honors level. These attributes encompass values related to emotional stability, social justice, creative and critical thinking, well-being and various skills required for employability, thus preparing students for continuous learning and sustainability. The new curriculum based on learning outcomes of BSc (Honours) Botany offers knowledge of areas including Plant Systematics, Plant Biotechnology, Resource Botany, Genetics, Ecology, Conservation biology, Physiology and Bioinformatics, Medicinal plants, Plant diseases management etc. The courses define clearly the objectives and the learning outcomes, enabling students to choose the elective subjects broadening their skills in the field of Botany. The course also offers skills to pursue research and teaching in the field of Botany and thus would produce best minds to meet the demands of society This curriculum framework for the bachelor-level program in Botany is developed keeping in view of the student-centric learning pedagogy, which is entirely outcome-oriented and curiosity-driven. To avoid a rote-learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts. The curriculum framework focuses on the pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works.

Aims of Bachelor's degree programme in Botany

The broad aims of the bachelor's degree programme in Botany are:

1. To provide an environment that ensures the cognitive development of students in a holistic manner. A dialogue about plants and their significance is fostered in this framework, rather than didactic monologues on mere theoreticalaspects
2. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-relatedemployment.
3. To mould a responsible citizen who is aware of the most basic domain-independent knowledge, including critical thinking andcommunication.
4. To enable the graduate to prepare for national as well as international competitive examinations, especially UGC-CSIR NET, and UPSC Civil ServicesExamination.

Program Learning Outcomes

The students graduating with the Degree B.Sc. Three years and B. Sc. (Honors) Botany should be able toacquire.

Core competency: Students will acquire core competency in the subject Botany, and allied subject areas.

1. The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms)plants.
2. Students will be able to use the evidence-based comparative botany approach to explain the evolution of organisms and understand the genetic diversity on the earth. The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome, and how organism's function is influenced at the cell, tissue, and organ level.
3. Students will be able to understand the adaptation, development, and behavior of different forms oflife.
4. The understanding of networked life on earth and tracing the energy pyramids through nutrient flow is expected from thestudents.
5. Students will be able to demonstrate the experimental techniques and methods of their area of specialization inBotany.

Analytical ability:

The students will be able to demonstrate the knowledge in understanding research and addressing practicalproblems.

1. Application of various scientific methods to address different questions by formulating the hypothesis, data collection, and critically analyze the data to decipher the degree to which their scientific work supports theirhypothesis.

Critical Thinking and problem-solving ability:

An increased understanding of fundamental concepts and their applications of scientific principles is expected at the end of this course. Students will become critical thinkers and acquire problem-solving capabilities.

Digitally equipped:

Students will acquire digital skills and integrate the fundamental concepts with modern tools.

Ethical and Psychological strengthing: Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.

Team Player: Students will learn team workmanship in order to serve efficiently institutions, industry, and society.

Independent Learner: Apart from the subject-specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitiveexaminations,andemployment.Learningoutcomes-basedcurriculumwouldensure equal academic standards across the country and a broader picture of their competencies. The Bachelor's program in Botany and Botany honors may be mono-disciplinary or multidisciplinary with following broad objectives.

1. Critically evaluation of ideas and arguments by collecting relevant information about the plants, to recognize the position of the plant in the broad classification and phylogenetic level.
2. Identify problems and independently propose solutions using creative approaches,

acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.

3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of the plant in taxonomy.
4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports theirhypotheses.
5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicingscientists.
6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of theseworks.
7. Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biologicalsituations.
8. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, and fungi that differentiate them from each other and other forms oflife.
9. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and lifehistory.
10. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, andecosystems
11. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization withinbiology.

B. Sc. Botany Course outcomes under NEP program

The framework of curriculum for the Bachelor's program in Botany aims to transform the course content and pedagogy to provide a multidisciplinary, student-centric, and outcome-based, holistic education to the next generation ofstudents.

Aside from structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels; keeping in mind the job prospects; the emphasis has been to maintain academic coherence and continuum throughout the program of study and help build a strong footing in the subject, thereby ensuring a seamless transition into theircareers.

Special attention is given to eliminate redundancy, discourage rote learning, and espouse a problem-solving, critical thinking, and inquisitive mindset among learners.

The curriculum embraces the philosophy that science is best learned through experiential learning, not limited to the confines of a classroom but rather through hands-on training, projects, field studies, industrial visits, andinternships.

This updated syllabus, with modern technology, helps students stay informed on the leading-edge developments in plant sciences and promotes curiosity, innovation, and a passion for research, that will serve them well in their journey into scientific adventure and discovery beyondgraduation.

The goal is to equip students with holistic knowledge, competencies, professional skills, and a strong positive mindset that they can leverage while navigating the current stiff challenges of the job market.

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome based education (OBE) for details on Program Outcomes)

PO1: Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.
PO2: Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.
PO3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.
PO4: Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.
PO5: Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

PO6: Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

PO7: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..

PO8: Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

PO 9: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC etc.

PO10: To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

PO 11: The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies etc at the right opportunity.

PO 12: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career.

RANI CHANNAMMA UNIVERSITY

VIdya Sangam, NH-4, Belagavi. -591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Botany Major& One Minor Discipline Scheme for the Four Years B.Sc. Undergraduate Honors Programme with effect from 2021-22

SEMESTER-I											
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	3
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	3
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1BOT1L	Microbial Diversity and technology	40	60	100	4	-	-	4	3
	21BSC1BOT1P	Microbial Diversity and technology	15	35	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			15	35	50	-	-	4	2	3
SEC1	21BSC1SE1CS1	Digital Fluency	15	35	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education - Yoga	15	35	50	-	-	2	1	2
VBC2	21BSC1V2HW1	Health & Wellness	15	35	50	-	-	2	1	2
OEC1	21BSC1BOT1		40	60	100	3	-	-	3	3
			Total Marks		**750**	**Semester Credits**			**25**	

SEMESTER-II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	3
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	3
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2BOT2L	Diversity of Non flowering plants	40	60	100	4	-	-	4	3
	21BSC2BOT2P	Diversity of Non flowering plants	15	35	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	30	70	100	4	-	-	4	3
			15	35	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	15	35	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education-Sports	15	35	50	-	-	2	1	2
VBC4	21BSC2V4NC1	NCC/NSS/R&R(S&G) / Cultural	15	35	50	-	-	2	1	2
OEC2	21BSC2BOT2		40	60	100	3	-	-	3	3
			Total Marks		**750**	**Semester Credits**			**25**	

SECOND YEAR; SEMESTER-III										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	3
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	3
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC2BOT3L	Plant Anatomy and Developmental Biology	40	60	100	4	-	-	4	3
	21BSC2BOT3P	Plant Anatomy and Developmental Biology	15	35	50	-	-	4	2	3
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			15	35	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	15	35	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	15	35	50	-	-	2	1	2
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S &G) / Cultural	15	35	50	-	-	2	1	2
OEC3	21BSC2BOT3		40	60	100	3	-	-	3	3
			Total Marks		**750**	**Semester Credits**			**25**	

SEMESTER-IV										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	3
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	3
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC2BOT4L	Ecology and Conservation Biology	40	60	100	4	-	-	4	3
	21BSC2BOT4P	Ecology and Conservation Biology	15	35	50	-	-	4	2	3
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			15	35	50	-	-	4	2	3
AECC2	21BSC4AE1ES2	Constitution of India	15	35	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Physical Education-Sports	15	35	50	-	-	2	1	2
VBC8	21BSC4V6NC3	NCC/NSS/R&R(S&G) / Cultural	15	35	50	-	-	2	1	2
OEC4	21BSC2BOT4		40	60	100	3	-	-	3	3
			Total Marks		**750**	**Semester Credits**			**25**	

B.Sc. BOTANY: Semester - 3

Theory: Discipline Specific Core Course (DSCC)

Title of the Course and Code:

BOT-A-3.1:PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BOT A-3.1	DSCC	Theory	04	04	52 hrs	4hrs	40	60	100

Course Outcomes:

On completion of this course, the students will be able to:

1.Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.

2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.

3. Induction of the enthusiasm on internal structure of locally available plants.

4. Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.

5. Observation and classification of the floral variations from the premises of college and house.

6. Understanding the various reproductive methods sub-stages in the life cycle of plants

7. Observation and classification of the embryological variations in angiosperms.

8. Enthusiasm to understand evolution based on the variations in reproduction among plants.

PLANT ANATOMY

Unit 1: ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES 14 Hrs

Introduction,objectiveand scope of Plant Anatomy, Plant cell structure – nature of plant cell wall. Tissue and tissue systems - meristematic tissue, permanent tissue and secretary cells. Classification of meristem: (apical, intercalary and lateral), primary and secondary meristem. Apical meristem: Theories, **concept and Evolution** on organization of meristem (apical cell theory, Tunica-Corpus theory, histogen theory and Korper-Kappe theory), quiescent centre, Root cap.

Unit II: MORPHOGENESIS AND DIFFERENTIATION 14 Hrs.

Morphogenesis in plants - Differentiation of root, stems and leaf. Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves. Structure of Dicot root: primary and secondary structures (Tridax/Sunflower), Structure of monocot root (Maize). Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Nodal anatomy. Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize),, Stomatal types. Anomalous secondary growth: Bignonia, Boerhaavia (dicot stem) Dracaena (monocot stem)

DEVELOPMENT BIOLOGY

Unit III: Morphogenesis and Differentiation 14 Hrs.

Differentiation and cell polarity in acellular (Dictyostelium), Unicellular (Acetabularia) and multicellular system (root hair and stomata formation) Shoot Apical meristem (SAM): Origin, structure and function,: Differentiation of root, stem, leaf Transition from vegetative apex into reproductive apex

Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence – a general account.

Unit IV: Reproductive Biology 14 Hrs.

Introduction, Scope and contributions of Indian embryologists:

P. Maheswari, B G L Swamy, M.S. Swaminathan and K.C. Mehta.

Microsporangium: Development and structure of mature anther, Anther wall layers, Tapetum - types, structure and functions and sprogenous tissue.

Microsporogenesis - Microspore mother cells, microspore tetrads, Pollinia.

Microgametogenesis – Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon). **Megasporangium –** Structure of typical Angiosperm ovule.Types of ovule- Anatropous, Orthotropous, Amphitropous, Circinotropous.

Megagametogenesis – Types of development of Female gametophyte/embryosac-monosporic- Polygonum type, bisporic – Allium type, tetrasporic - Fritillaria type. Structure of mature embryosac.

Pollination and fertilization: Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.

Endosperm – Types and its biological importance. Free nuclear (Cocos nucifera) cellular (Cucumis), helobial types. Ruminate endosperm.

Embryogenesis – Structure and composition of zygote ,Dicot (Capsella bursa-pastoris)and Monocot (Najas) embryo development. A general account of seed development.

B.Sc. BOTANY: Semester - 3

Theory: Discipline Specific Core Course (DSCC)

Title of the Course and Code:

BOT-A-3.2: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BOT A-3.2	DSCC	Practical	02	04	52 hrs	4hrs	25	25	50

Practical No.1

i) Study of meristem (Permanent slides/ Photographs).

ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma)and Complex Tissues (xylem and phloem).

Practical No.2

Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize)

Practical No.3

Study of Normal secondary growth structure in dicot stem and root (Sunflower) and Anomalous secondary growth: Bignonia, Boerhaavia (dicot stem) Dracaena (monocot stem)

Practical No. 4

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials

Practical No. 5

Permanent slides of Microsporogenesis and male gametophyte Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis

Practical No. 6

Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination

Practical No. 7

Permanent slides of types of ovules, Megasporogenesis &embryosac development and types of placentation: Axile, Marginal and Parietal types. Sectioning of ovary, for the studied types of placentation

Practical No. 8

Mounting of embryo: Tridax and Cyamopsis, Mounting of endosperm: Cucumis

Practical No. 9 and 10

Mini project work in groups of 3-5 students, from the following list

a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.

b) Pollen germination of different pollen grains and calculates percentage of germination.

c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.

d) Study of placentation of different flowers.

e) Any other relevant study related to Anatomy / Embryology.

Text Books for Reference:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms, Woong-Young Soh, Springer Netherlands,
3. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
14. Pandey S.N. 1997, Plant Anatomy and Embryology .A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi 16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publication

RANI CHANNAMMA UNIVERSITY BELGAVI

B.Sc III SEMESTER

SUBJECT: BOTANY (OPEN ELECTIVE COURSE) OEC CODE:-003 BOT 051

Cou rse No.	Typ e of Cou r se	Theory / Practica l	Credit s	Instructi o n hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
003 BOT 051	OE C	Theory	03	03	42 Hrs	2 Hrs	40	60	100

OEC-3 (OEC for other students): 003 BOT 051

Title of the Paper: BOTANICAL GARDEN AND LANDSCAPING

Learning outcomes:

After the completion of this course the learner will be able to: Apply the basic principles and components of gardening

- **Conceptualize flower arrangement and bio-aesthetic planning**
- **Design various types of gardens according to the culture and art of bonsai**
- **Distinguish between formal, informal and free style gardens**

•Establish and maintain special types of gardens for outdoor and indoor landscaping

Keywords:

Gardening, Landscaping, Flower arrangement, Vertical gardens, Roof gardens,Computer aided designing

Unit-I	**Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Green house, Special types of gardens, trees, their design, values in land scaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, planting, climbers and creepers, palms, ferns, grasses and cacti succulents.**	**14 Hrs**

Unit II	**Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.**	**14 Hrs**
Unit III	**Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Land scape designs, Styles of garden, formal, informal and freestyle gardens, types of gardens, Urban land scaping, Land scaping for specific situations, institutions, industries, residents, hospitals, road sides, traffic islands, dam sites, IT parks, corporate. Establishment and maintenance, special types of gardens, Bioaesthetic planning, eco- tourism, indoor gardening, therapeutic gardening, non-plant components, water-scaping, xeri-scaping, hardscaping; Computer Aided Designing (CAD) for outdoor and indoor scaping Exposure to CAD (Computer Aided Designing) components of a nursery, sowing, pricking, use of greenhouse for nursery production, propagation through cuttings, layering, grafting and budding. Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethno-botany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India.**	**14 Hrs**
	Suggested Readings: **1. Berry, F. and Kress, J. (1991). Heliconia: An Identification Guide. SmithsonianBooks** **2. Butts, E. and Stensson, K. (2012). Sheridan Nurseries: One hundred years ofPeople, Plans, and Plants. Dundurn Group Ltd.** **3. Russell, T.(2012). Nature Guide: Trees: The world in your hands (Nature Guides).**	

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Asesment	Weightage	Duration	Comment
Written Test -1	**10%**	**1 Hrs**	**8th Week**
Written Test-2	**10%**	**1 Hrs**	**12th Week**
Seminar	**10%**	**10 minutes**	**--------**
Case Study/Assignment/Field Work/Project Work/Activity	**10%**	**--------**	**--------**
Total	**40% of the Maximum Marks allotted for the paper.**		

Faculty of Science

04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for OEC

(60 Marks for semester end Examination with 2 hrs duration)

1	Part-A	Question number 1-6 carries 2 marks each. Answer any 5 questions.	10 Marks
2	Part-B	Question number 7-11 carries 5 marks each. Answer any 4 questions.	20 Marks
3	Part-C	Question number 12- 15 carries 10 marks each. Answer any 3 question.	30 Marks
(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)			
Total -60 Marks			

Practical Question Paper Pattern

RANI CHANNAMMA UNIVERSITY ELGAVI

B.Sc Botany III Semester (NEP) Plant

Anatomy and Development Biology

Time: 04 Hrs Max Marks: 25

Q No I	**Make a double stained micro preparation of T.S of material 'A' Draw a labeled diagram (Show the preparation to the Examiners)**	**05 Marks**
Q No II	**Mount Endosperm/Embryo in specimen 'B' and draw the diagram (Show the preparation to the Examiners)**	**05 Marks**
Q No III	**Identify and mention the important features observed in the slides C,D,E,F and G.**	**10 Marks**
Q No IV	**Mini Project Submission**	**05 Marks**
	Total	**25**

Instruction to Examiners

Q No I- For double staining preparation give the stem of Bignonia,Boerhaavia &

Dracena stem any one.

Preparation -03 Diagram -02 (05)

Q No II-Mount Endosperm/ Embryo

Preparation -03 Diagram -02- (05)

Q No III- Two slides from Anatomy(C-Simple tissue & D-Complex tissue),

Two slides from Embryology (E & F) and 'G'- Trichome/ Stomata.

(10)

Submission (05)

Question Paper Pattern

RANI CHANNAMMA UNIVERSITY BELGAVI

B.Sc Botany III Semester (NEP)

Subject: Code: Maximum Marks: 60

Answer any Six Questions from Question no I
Answer any Three each Questions from Question no II, III, IV and V

QNO I	Answer any Six Questions (At least Two questions from each unit) 1 2 3 4 5 6 7 8	2X6=12
QNO II	Should cover Entire unit I 1 2 3 4	4X3=12
QNO III	Should cover Entire unit II 1 2 3 4	4X3=12
QNO IV	Should cover Entire unit IIII 1 2 3 4	4X3=12
QNO V	Should cover Entire unit IV 1 2 3 4	4X3=12

B.Sc. B0TANY SEMESTER IV

Title of the Course: Ecology and Conservation Biology

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
04	**56**	**02**	**56**
	Contents of Theory Course		
Unit 1	**Topics**		**Teaching Hours**
Unit I	Introduction to Ecology and Conservation Biology: Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation. Ecological factors:Climatic factors:light, temperature, precipitation and humidity. Edaphic factors:Soil and its types, soil texture, soil profile, soil formation; physicochemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms. Topographic Factors: Altitude Ecological groups of plants and their adaptations:Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.		**15 Hrs**
Unit II	Ecosystem Ecology:Introduction,types of ecosystems with examples -terrestrial and aquatic, natural and artificial. Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem. Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem. Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cyclePhosphorus. Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere. Community Ecology: Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes. Intra-specific and Inter-specific interactions with examples. Ecological methods and techniques: Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping. Population Ecology: Population and its characteristics – Population density, natality, mortality, age distribution,		**15 Hrs**

	population growth curves and dispersal.	
Unit III	Phytogeography and Environmental issues: Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov's concept, types. Phytogeographical regions – concept, phytogeographical regions of India. Vegetation types of Karnataka – Composition and distribution of evergreen, semievergreen, deciduous, scrub, mangroves, shoal forests and grasslands. An account of the vegetation of the Western Ghats. Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment). Water pollution disasters – National mission on clean Ganga ,Minimata, Pacific gyre garbage patch, Exxon valdez oil spill. Air pollution: Causes, effect, air quality standards, acid rain, control. Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.	**11 Hrs**
Unit IV	*Biodiversity and its conservation: Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG's in biodiversity conservation. Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity. Concept of Biodiversity Hotspots, Biodiversity hot spots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/ Western Ghats. Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002). Conservation methods – In-situ and ex-situmethods In-situmethods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves. Ex-situmethods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.*	**15 Hrs**
	Total	**56 Hrs**

SUGGESTED REFERENCE BOOKS:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.

2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.

3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.

4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,

5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.

6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.

7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.

8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.

9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel. 10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers

List of Practical's in Ecology and Conservation Biology

Practical No.	Experiments
1	Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.
2	Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
3	Hydrophytes: Morphological adaptations in Pistia, Eichhornia, Hydrilla, Nymphaea. Anatomical adaptations in Hydrilla(stem) and Nymphaea (petiole).
4	Xerophytes: Morphological adaptations in Asparagus, Casuarina, Acacia, Aloe vera, Euphorbiatirucalli. Anatomical adaptations in phylloclade of Casuarina .
5	Epiphytes: Morphological adaptations in Acampe, Bulbophyllum, Drynaria.Anatomical adaptations in epiphytic root of Acampe/ Vanda. Halophytes: study of Viviparyin mangroves, Morphology and anatomy of Pneumatophores.
6	Study of a pond/forest ecosystem and recording the different biotic and abiotic components
7	Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of Density and frequency.
8	Application of remote sensing to vegetation analysis using satellite imageries
9	Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book.
10	Determination of water holding capacity of soil samples
11	Determination of Biological oxygen demand (BOD)
12	Determination of Chemical oxygen demand (COD)
13	Determination of soil texture of different soil samples.

RANI CHANNAMMA UNIVERSITY BELGAVI

B.Sc IV SEMESTER OPEN ELECTIVE COURSE (OEC-4)

PAPER: MEDICINAL PLANTS IN HEALTH CARE

SUBJECT: BOTANY (OEC CODE:-004 BOT 051

Cou rse No.	Typ e of Cou r se	Theory / Practica l	Credit s	Instructi o n hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
004 BOT 051	OE C	Theory	03	03	42 Hrs	2 Hrs	40	60	100

OEC-4 (OEC for other students): 004 BOT 051

Title of the Paper: MEDICINAL PLANTS IN HEALTH CARE

Learning outcomes:

On completion of this course, the students will be able to: Recognize the basic medicinal plants

- **Apply techniques of conservation and propagation of medicinal plants.**
- **Setup process of harvesting, drying and storage of medicinal herbs**
- **Propose new strategies to enhance growth of medicinal herbs considering**
- **thepractical issues pertinent to India**

Keywords:

Medicinal plants, Traditional systems, endangered medicinal plants, Ethnobotany, Folk medicines, Ethnic communities

Unit-I	**History and Traditional System of Medicine** **History, Scope and Importance of Medicinal Plants; Traditional systems of medicine;Definition and Scope. Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana,plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments / therapy, polyherbal formulations.**	**14 Hrs**

Unit II	**Conservation, Augmentation and Ethnobotany and Folk Medicine Conservation of Endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important**	**14 Hrs**
Unit III	**Medicinal Plants** **Brief description of selected plants and derived drugs, namely Guggul (Commiphora) for hypercholesterolemia, Boswellia for inflammatory disorders, Arjuna (Terminalia arjuna) for cardioprotection, turmeric (Curcuma longa)f or wound healing, antioxidant and anticancer properties, Kutaki (Picrorhiza kurroa) for hepatoprotection, Opium Poppy for analgesic and antitussive, Salix for analgesic, Cincona and Artemisia for Malaria, Rauwolfia as tranquilizer, Belladona as anticholinergic, Digitalis as cardiotonic, Podophyllum as antitumor**	**14 Hrs**
	Suggested Readings: **1. Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.** **2. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yogaand Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.** **3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation.** **4. Dev, S. (1997). Ethno-therapeutics and modern drug development: The potential of Ayurveda. Current Science 73:909–928.** **5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16thedn. Philadelphia, PA: Elsevier Saunders Ltd.** **6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi** **7. Kapoor, L.D. (2001). Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.** **8. Saroya, A.S. (2017). Ethnobotany. ICAR publication.** **9. Sharma, R.(2003). Medicinal Plants of India-An Encyclopaedia. Delhi: DayaPublishing House.** **10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House,Delhi.** **11. Thakur, R.S., H.S. Puri, and Husain, A.(1989). Major medicinal plants of India.Central Institute of Medicinal and Aromatic Plants, Lucknow, India.**	

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Asesment	Weightage	Duration	Comment
Written Test -1	10%	1 Hrs	8th Week
Written Test-2	10%	1 Hrs	12th Week
Seminar	10%	10 minutes	--------
Case Study/Assignment/Field Work/Project Work/Activity	10%	--------	--------
Total	40% of the Maximum Marks allotted for the paper.		

Faculty of Science

04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for OEC

(60 Marks for semester end Examination with 2 hrs duration)

1	Part-A	Question number 1-6 carries 2 marks each. Answer any 5 questions.	10 Marks
2	Part-B	Question number 7-11 carries 5 marks each. Answer any 4 questions.	20 Marks
3	Part-C	Question number 12- 15 carries 10 marks each. Answer any 3 question.	30 Marks
(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)			
Total -60 Marks			

Practical Question Paper Pattern

RANI CHANNAMMA UNIVERSITY BELGAVI

B.Sc Botany IV Semester
(NEP) Ecology and
Conservation Biology

Time: 04 Hrs Max Marks: 25

Q No I	**Give the External and Internal features of Ecological adaptations with neat labeled diagram of specimen 'A'**	**05 Marks**
Q No II	**Determination of PH different types of Soils/Water samples 'B'**	**05 Marks**
Q No III	**Identify and describe the features of Ecological interest in slides C and D**	**06 Marks**
Q No IV	**Describe the use and mechanism of Ecological Instrument ' E'**	**04 Marks**
Q No V	**Submission of Field Visit Report**	**05 Marks**
	Total	**25**

Instruction to Examiners

Q No I- Ecological Adaptations- Hydrophytes/Xerophytes/Epiphytes 'A' Preparation -03 Diagram -02 (05)

Q No II-Determination of PH Soil/ Water 'B' (05)

Q No III- Ecological slides – Hydrophytes/Xerophytes/Epiphytes (06)

(Not repeat the Q No I)

Q No IV- Any one Ecological Instrument 'E (04)

Submission of Field Visit Report (05)

Question Paper Pattern

RANI CHANNAMMA UNIVERSITY BELGAVI

B.Sc Botany IV Semester (NEP)

Subject: Code: Maximum Marks: 60

Answer any Six Questions from Question no I

Answer any Three each Questions from Question no II, III, IV and V

QNO I	Answer any Six Questions (At least Two questions from each unit) 1 2 3 4 5 6 7 8	2X6=12
QNO II	Should cover Entire unit I 1 2 3 4	4X3=12
QNO III	Should cover Entire unit II 1 2 3 4	4X3=12
QNO IV	Should cover Entire unit IIII 1 2 3 4	4X3=12
QNO V	Should cover Entire unit IV 1 2 3 4	4X3=12

RANI CHANNAMMA UNIVERSITY,BELAGAVI.

PROGRAM / COURSE STRUCTURE AND SYLLABUS

Learning Outcomes-Based on Curriculum Frame work (LOCF) of National Education Policy (NEP) 2020

Bachelor of Science

Botany

B.Sc. V & VI semester

w.e.f.

Academic Year 2023-24 onwards

BOTANY

V Semester

	Course Code	Course Title	Credits Assigned	Instructional hours per week		Duration of exam	IA	Exam	Total
DSC	21BSC5BOT 5L1	Plant morphology and taxonomy (Theory)	4	4		2	40	60	100
	21BSC5BOT 5P1	Plant morphology and taxonomy (Practical)	2		4	3	25	25	50
	21BSC5BOT 5L2	Genetics and Plant Breeding (Theory)	4	4		2	40	60	100
	21BSC5BOT 5P2	Genetics and Plant Breeding (Theory)	2		4	3	25	25	50

VI Semester

	Course Code	Course Title	Credits Assigned	Instructional hours per week		Duration of exam	IA	Exam	Total
DSC	21BSC6BOT 6L1	Cell Biology (Theory)	4	4		2	40	60	100
	21BSC6BOT 6P1	Cell Biology (Practical)	2		4	3	25	25	50
	21BSC6BOT 6L2	Plant Physiology and Biochemistry (Theory)	4	4		2	40	60	100
	21BSC6BOT 6P2	Plant Physiology and Biochemistry (Practical)	2		4	3	25	25	50

Course Code	Course Title	Credits Assigned	Submission	Viva-voce	Total
	Project	2	25	25	50

V Semester

Plant Morphology and Taxonomy (Theory)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**Plant Morphology and Taxonomy (Theory)**		
Course Code:	**DSC** – 21BSC5BOT 5L1	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of SEA/Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite(s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1.Understanding the main features in Angiosperm evolution
CO2.Ability to identify, classify and describe a plant in scientific terms, thereby, Identification of plants using dichotomous keys. Skill development in identification and classification of flowering plants.
CO3.Interpret the rules of ICN in botanical nomenclature.
CO4.Classify Plant Systematic and recognize the importance of herbarium and Virtual Herbarium, Evaluate the Important herbaria and botanical gardens.

CO5. Recognition of locally available angiosperm families and plants and economically important plants. Appreciation of human activities in conservation of useful plants from the past to the present.

Contents	**56 hrs**
Unit I	**14hrs**
Morphology of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits–types. Floral diagram and floral formula. **Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Bentham & Hooker's, Engler and Prantl's system and Merits anddemerits of classification. **Taxonomic literatures:** Floras, Monograph. Revisions, Journals. **Herbaria and Botanical gardens:** Important herbaria and Botanical gardens of the world and India, technique of Herbarium Preparation. **Virtual herbarium:** E-flora, Documentation.	
Unit II	**14hrs**
Plant identification: Taxonomic dichotomous keys; intended (yolked) and bracketed keys. (Brief account only). **Plant descriptions**: Common terminologies used for description of vegetative and reproductive parts of the following families.	
Study of the diagnostic features of Angiosperm families : Annonaceae, Brassicaceae, Malvaceae, Fabaceae (with sub Families), Apiaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae,Euphorbiaceae, Orchidaceae ,Liliaceaeand Poaceae. **Plant Taxonomic Evidences:** from palynology embryology, cytology, phyto-chemistry and molecular data. Field inventory.	

Unit III	14hrs
Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. **Botanical Nomenclature:** Principles and rules (ICN); Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, Author citation., valid publication, rejection of names, principle of priority and its limitations; Names of hybrids/cultivated species.	
Unit IV	**14hrs**
Biometrics, Numerical Taxonomy; Phenetics and Cladistics: Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences). **Phylogenetic Systematics:** Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly, clades, synapomorphy, symplesiomorphy, apomorphy, lineage sorting, serial homology etc). **Origin and evolution of angiosperms;** Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). **Molecular taxonomy:** DNA sequences of chloroplast genes (*atp*B, rbcl.,) and one nuclear gene (nuclear ribosomal 18s DNA).	

V Semester

Plant Morphology and Taxonomy (Practical)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**Plant Morphology and Taxonomy (Practical)**	Practical Credits	**02**
Course Code	**DSC** – 21BSC5BOT 5P1	Contact Hours	**4 Hours per week**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

1. Study of root, stem and leaf structure and modifications. Study of inflorescence types. Study of flower and its parts, Study of fruits. Floral diagram and floral formula. **04 hrs**

2. Study of families mentioned in theory with at least two examples for each family and make suitable diagrams, describe them in technical terms (Description, V.S. flower, section of ovary, floral diagrams, floral formulae and systematic position according to Bentham & Hooker's system of classification) and identify up to species using the flora. **26 hrs**

3. Construction of plant phylogenetic trees using various loci (*atp*B & rbcL,) with various phylogenetic methods (Neibour Joining, Maximum Likelihood etc). (Demonstration). **06 hrs.**

4. Identify plants / plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family and morphology of useful parts. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilly, Tamarind, Bitter gourd, *Luffa*, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Ginger, Turmeric, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *Annonamuricata*, *Catharanthus roses*, *Rauvolfia serpentaina*, *Justicia Adhatoda*, *Vitex nigundo* and *Leucas aspera*. **16 hrs.**

5. **Field visit**: Local or outside area / Botanical garden/ tribal settlements minimum 3 to 5 days.

6. Submission: Record book, Tour report and Herbarium Preparation of 10 properly identified herbarium specimens; (mounting of a properly dried and pressed specimen of any common plants from your locality with herbarium label).

Pedagogy: Teaching and learning, conducting experiments, field visits.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

Time: 3 hours. **Max marks: 25**

1. Identify, classify and describe the specimen A & B taxonomically	6 Marks
2. Identify the given specimen C with the help of Key using Flora	4 Marks
3. Draw the floral diagram and write floral formula of the given specimen D	2 Marks
4. Identification of Specimen/slides E, F and G	6 Marks
5. Tour report	2 Marks
6. Submission (Herbarium- any 10 local plants)	5 Marks

Total 25 marks General instructions:

Q1. Give specimen from Dicotyledons (A) and Monocotyledons (B)
Q2. Give specimen from family they studied (C)
Q3. Give specimen from family they studied (D)
Q4. Specimen /Slides/ materials from Root/Stem/ Leaf/ Inflorescence (E), Flower/Fruit (F) and Economic importance (G)
Q5. Tour report
Q6. Submission (Herbarium- any 10 local plants)

References	
1	Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
2	Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester
3	Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons
4	Datta S C, 1988. *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi,
5	Eames A. J. - *Morphology of Angiosperms* - McGraw Hill, New York.
6	Hall, B.G. 2011. *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc. USA
7	Heywood - *Plant taxonomy* - Edward Arnold London.
8	Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.
9	Jeffrey, C. (1982). An Introduction to *Plant Taxonomy.* Cambridge University Press, Cambridge
10	Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *Plant Systematics: A Phylogenetic approach,* 2nd edition. Sinauer Associates, Inc., USA.
11	Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
12	Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi.
13	Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi.
14	Manilal, K.S. 2003. *Van Rheede's Hortus Malabaricus. English Edition*, with Annotations and Modern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
15	Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
16	Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
17	Radford A B, W C Dickison, J M Massey & C R Bell, 1974.*Vascular Plant Systematics*, Harper & Row Publishers, New York.
18	Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
19	Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
20	Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi.
21	Any local / state / regional flora published by BSI or any other agency.

V Semester

Genetics and Plant Breeding (Theory)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**Genetics and Plant Breeding (Theory)**		
Course Code:	**DSC** – 21BSC5BOT 5L2	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

ourse Pre-requisite (s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:.
CO1.Understand the basics of genetics and plant breeding
CO2.Ability to identify, calculate and describe crossing over, allelic generations and frequencies of recombination.
CO3.Interpret the results of mating and pollinations.
CO4.Classify plant pollination methods
CO5. Recognition of modes of inheritance of traits/ phenotypes and phenotype-genotype correlation.

Contents	**56 Hrs.**
Unit I	**14 hrs.**
Mendelian genetics and its extension Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and Co-dominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominanttraits, Penetrance and Expressivity, Numericals and polygenic inheritance. Extra chromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast.	
Unit II	**14hrs**
Linkage, crossing over and chromosome mapping: Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numerical based on gene mapping; Sex Linkage. Variation in chromosome number and structure: **Gene mutations:** Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CLB method, Role of Transposons in mutation, DNA repair mechanisms. Fine structure of gene (Population and Evolutionary Genetics**,** Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, Genetic drift, Genetic variation and Speciation.	

Unit III	14hrs
Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement. Introduction: Centers of origin and domestication of crop plants, plant genetic resources, Acclimatization. **Selection methods: S**elf-pollinating and cross-pollinating plants and types of vegetative propagation in plants.	
Unit IV	**14hrs**
Hybridization: self, cross and vegetative propagation in plants – Procedure, advantages and limitations. **Quantitative inheritance:** Concept, mechanism, examples of inheritance of Kernel colour in wheat, Monogenic vs Polygenic inheritance.	

Inbreeding depression and heterosis: History, genetic basis of inbreeding depression and heterosis; Applications.
Role of mutations in crop improvement; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

V Semester

Genetics and Plant Breeding (Practical)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**Genetics and Plant Breeding (Practical)**	Practical Credits	**02**
Course Code	**DSC** – 21BSC5BOT 5P2	Contact Hours	**4 Hours per week**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

Practical Content

Practical: Plant breeding:

1. Reproductive biology, self and cross pollinated plants; vegetative propagation
2. Hybridization: Emasculation, bagging, pollination and production of hybrids and pollen fertility
3. Origin, distribution and centres of diversity of crop plants: Wheat, Sorghum, Rice, Chilly Sugarcane, Cotton, Potato, coffee, Sunflower and groundnut
4. Visit to nursery / horticulture.

Practical: Genetics

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex-linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

Pedagogy: Teaching and learning, conducting experiments, field / Lab.visits

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

Time: 3 Hrs **Max. Marks: 25**

1. Perform the emasculation / pollen viability / fertility of the given sample **A**	5 Marks
2. Solve the given genetic problem **B**	4 Marks
3. Identification of Specimen/slides/ Photographs **C, D** and **E**	6 Marks
4. Viva Voce	5 Marks
5. Submission (Report of visit to nursery/horticulture)	5 Marks

General instructions:
Q1 Material **Cassia**// **Hibiscus**/ etc (A)
Q2. Genetic problems (B)

Q3. Down's, Klinefelter's and Turner's syndromes, Translocation Ring, Laggards and Inversion Bridge (C, D and E)
Q4. Viva voce
Q5. Submission (Report of visit to nursery/horticulture)

References	
1	Acquaah, G.(2007). Principles of Plant Genetics &Breeding.NewJearsey, U.S.: Blackwell Publishing.
2	Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3	Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.
4	Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons
5	Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th
	edition. New York, NY: W.H. Freeman and Co.
6	Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co.
8	Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9	Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut
10	Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi.

VI Semester

CELL BIOLOGY (THEORY)

Program Name	**B.Sc. in BOTANY**	Semester	**VI**
Course Title	**Cell Biology (Theory)**		
Course Code:	**DSC-**21BSC6BOT 6L1	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite (s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:. CO1. Understanding of Cell metabolism, chemical composition, physiochemical and functional organization of organelle

CO2. Contemporary approaches in modern cell and molecular biology.
CO3.To study the organization of cell, cell organelles and biomolecules (i.e protein, carbohydrate, lipid and nucleic acid)
CO4.To gain knowledge on the activities in which the diverse macro molecules and microscopic structures inhabiting the cellular world of life are engaged.
CO5.To understand the various metabolic processes such as respiration, photosynthesis etc. which are important for life.

Contents	**56 Hrs**
Unit I	**14hrs**
Structure of Plant Cell – Prokaryotic and Eukaryotic cell, plasma membrane (fluid mosaic Model), Mitochondria, Chloroplast, Nucleus and ribosomes. Chromosomes: History, types and functions of chromosomes. Giant chromosomes, Polytene chromosome and Lampbrush chromosome.	
Unit II	**14hrs**
Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryotic cells (primary and secondary wall), Glycocalyx, Cell-cell interactions / Junctions, pit connections. Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle-checkpoints, role of protein kinases. Programmed Cell Death; Biology and elementary knowledge of development and causes of cancer.	
Unit III	**14hrs**
Active and passive transport, proton pumps associated (Na-K, Cacalmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis. Marker enzymes in cell organelles, Biogenesis of mitochondria and chloroplasts, brief account of transport in mitochondria and chloroplasts (Tim/Tom; Tic/Toc) and semiautonomous nature of mitochondria and chloroplast	
Unit IV Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclearmembrane, Nucleolus, rRNA processing. **Endoplasmic Reticulum**: Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids. **Golgi Apparatus**: organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes.	**14hrs**

VI Semester
CELL BIOLOGY (Practical)

Course Title	**Cell Biology (Practical)**	Practical Credits	**02**
Course Code	**DSC**-21BSC6BOT 6P1	Contact Hours	**4 Hours per week**
Formative Assessment	**25Marks**	Summative Assessment	**25 Marks**

Practical Content

1. Study of plant cell structure with the help of epidermal peel mount of Onion/ *Rhoeo*/ Crinum.
2. Study of cell and its organelles with the help of electron micrographs.
3. Measurement of length and breadth of plant cell using micrometry.
4. Study different stages of mitosis and meiosis (Onion/ *Rhoeo*/ Crinum)
5. Study of Karyotype using camera-lucida / chart.
6. Isolation of cell organelle – Chloroplast.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

CELL BIOLOGY

Time: 03 hrs **Max. Marks: 25**

1. Preparation of squash/ smear of material A, identify, Sketch and label the any two stages with reasons 06 marks
2. Find out cell length and breadth of the given material using micrometry 05marks
3. Identify the slides C & D 04 marks
4. Viva-voce 05 marks
5. Submission (submission of 5 slides of mitosis and meiosis) 05 marks

General instructions:

Q1. Give specimen from Onion/ *Rhoeo*/ *Crinum* plant (A)
Q2. Give specimen from Onion/ *Rhoeo* leaf (B)
Q3. Give slide from mitosis (C) meiosis (D)
Q4. Viva-voce
Q5. Submission (submission of 5 slides of mitosis and meiosis)

References	
1	Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.: ASM Press & Sunderland, Sinauer Associates, MA
2	Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
3	De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia.
4	Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San fransisco.
5	Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H.Freeman and Company
6	Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013). Essential cell biology (4th ed.). Garland Publishing.
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co.
8	Verma, P. S. (2004). Cell Biology,Genetics, Molecular Biology: Evoloution and Ecology. India: S. Chand Limited.

VI Semester
PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)

Program Name	**BSc BOTANY**	Semester	**VI**
Course Title	**Plant Physiology and Plant Biochemistry (Theory)**		
Course Code:	21BSC6BOT 6L2	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Pre-requisite (s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:
CO1.Importance of water and the mechanism of transport.
CO2.To understand biosynthesis and breakdown of biomolecules.
CO3.Role of plant hormones in plant development and about secondary metabolites.
CO4.Preliminary understanding of the basic functions and metabolism in a plant body.
CO5.To understand the importance of nutrients in plant metabolism and crop yield.

Contents	**56 hrs**
UNIT I	**14 hrs**
Plant water relations: Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption. **Transpiration.** Types and process, Mechanism of guard cell movement, K^+ ion mechanism, Antitranspirants. **Mechanism of ascent of sap:** Vital and physical force theories. **Phloem Transport:** Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis. **Mineral nutrition:** Micro and macro nutrients - their importance and deficiency symptoms.	
UNIT II	**14 hrs**
Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis;C3, C4 and CAM pathways of carbon fixation; Photorespiration. **Respiration**: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Oxidative Pentose Phosphate Pathway. **Nitrogen metabolism:** Biological nitrogen fixation: Nitrate and ammonia assimilation.	

UNIT III	**14 hrs**
Plant growth regulators: Definition and classification, Site of synthesis, biosynthesis pathway and metabolism and influence on plant growth development - Auxins, Gibberellins, cytokinins, ABA and ethylene . **Synthetic growth regulators**: Classification, their effect on plant growth and development. Practical utility in agriculture and horticulture. **Sensory Photobiology**: Biological clocks, photoperiodism, function & structure of phytochromes, phototropin & cryptochromes. Senescence, Aging & Cell Death (PCD and Autophagosis).Plant Movements	
UNIT IV	**14 hrs**
Biochemistry : **Introduction and scope of Biochemistry** **Carbohydrates** :Structure, Classification and functions of Carbohydrates **Enzymes:** Classification, kinetics and mechanism of action. **Proteins and amino acids**: Classification, structure - primary, secondary, tertiary and quaternary. Classification of Amino acids. **Vitamins**: Classification, distribution, structure, production, function. **Lipids:** Classification, structure, function and biosynthesis of fatty acids. **Secondary plant products**: Structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.	

VI Semester

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (Practical)

Course Title	**Plant Physiology and Biochemistry (Practical)**	Practical Credits	**2**
Course Code	21BSC6BOT 6P2	Contact Hours	**4 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**
Practical Content			
1. Experiment to demonstrate the phenomenon of exosmosis and endosmosis. 2. To determine the osmotic pressure of the cell sap by plasmolytic method. (Major) 3. To demonstrate root pressure / transpiration pull in plants. 4. To compare the rate of transpiration from the two surfaces of leaf by cobalt chloride paper method 5. To demonstrate that oxygen is liberated in the process of photosynthesis. 6. Separation of photosynthetic pigments by paper chromatography and measure their Rf values (Major) 7. Estimation of total chlorophyll content by Arnon method. (Major) 8. To isolate and identify the amino acids from a mixture using paper chromatography. (Major) 9. To Study of Phototrophism. 10. Qualitative test for Starch, Protein, Reducing Sugars and Lipids. 11. Estimation of TAN (Titratbale acid Number) from *Bryophllum* leaves /*Aloe vera*. (Major)			

SCHEME OF PRACTICAL EXAMINATION

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Time: 03 hrs **Max. Marks: 25**

1. Conduct Major Experiment A 06 marks
2. Comment on minor Experiments B & C 06 marks
3. Micro Chemical test D 03 marks
4. Viva-voce 05 marks
5. Practical Record 05 marks

General Instructions:

Q1. Osmotic potential/paper chromatographic separation of pigments **(A)**
Q2. $CoCl_2/O_2$ evolution/Root pressure/transpiration pull experiments **(B & C)**
Q3. Qualitative tests for Starch, Protein, Reducing Sugars and Lipids **(D)**
Q4. Viva-voce
Q5. Practical record

REFERENCES

1. Wilson, K. and Walker, J. 1994 Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc.
2. JainV K, 2008. Fundamentals of Plant Physiology.S Chand and Co.
3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.
4. Kumar and Purohit. Plant Physiology: Fundementals and Applications.Agrobotanical Publishers.
5. Malik CP, 2002. Plant Physiology. Kalyani publishers.
6. Mukherjii S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Culcutta.
7. Noggle GR, Fritz GJ, Introductory Plant Physiology.Prentice Hall of India.
8. Pandey SN, Sinha BK, 2006. Plant physiology.Vikas Publishing House, NewDelhi.
9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributers, NewDelhi.
10. Sinha A K, 2004. Modern Plant Physilogy. Narosa publishing House, NewDelhi.
11. Srivastava H S, 2004. Plant physiology and Biochemistry. Rasthogi publications.
12. Verma V, 2007.Text Book of Plant Physiology. Ane Books Pvt. Ltd.

General instructions for conducting project:

1. Project work is compulsory for all the students of B.Sc VI semester.

2. Assign the Title of the project related to Botany subject.

3. Marks are allotted based on the performance in Power point presentation, Vivo-voce and submission of dissertation.

4. Duration of the project work is minimum 2 months.

5. The project guide should maintain the attendance of the students.

6. Group of 4-5 students is assigned for each project.

Details of Formative Assessment (IA) For DSCC theory: 40%weightage for Total Marks

Type of Asesment	Weightage	Duration	Comment
Written Test -1	10%	1 Hrs	8th Week
Written Test-2	10%	1 Hrs	12th Week
Seminar	10%	10 minutes	--------
Case Study /Assignment / Field Work / Project Work / Activity	10%	--------	--------
Total	40% of the Maximum Marks allotted for the paper.		

Question Paper Pattern

RANI CHANNAMMA UNIVERSITY BELGAVI

B.Sc Botany V & VI Semester (NEP)

Subject:---------- Code:----------

Maximum Marks: 60

Answer any Six Questions from Question no I

Answer any Three each Questions from Question no II, III, IV and V

QNO I	Answer any **Six** of the following.(At least Two questions from each unit) 1 2 3 4 5 6 7 8	2X6=12
QNO II	Answer any **three** of the following (Should cover Entire unit I) 9. 10. 11. 12.	4X3=12
QNO III	Answer any **three** of the following (Should cover Entire unit II) 13. 14. 15. 16.	4X3=12
QNO IV	Answer any **three** of the following (Should cover Entire unit III) 17. 18 19 20	4X3=12
QNO V	Answer any **three** of the following (Should cover Entire unit IV) 21. 22 23 24.	4X3=12